MANUAL OF THE TREES OF NORTH AMERICA

CHARLES SPRAGUE SARGENT

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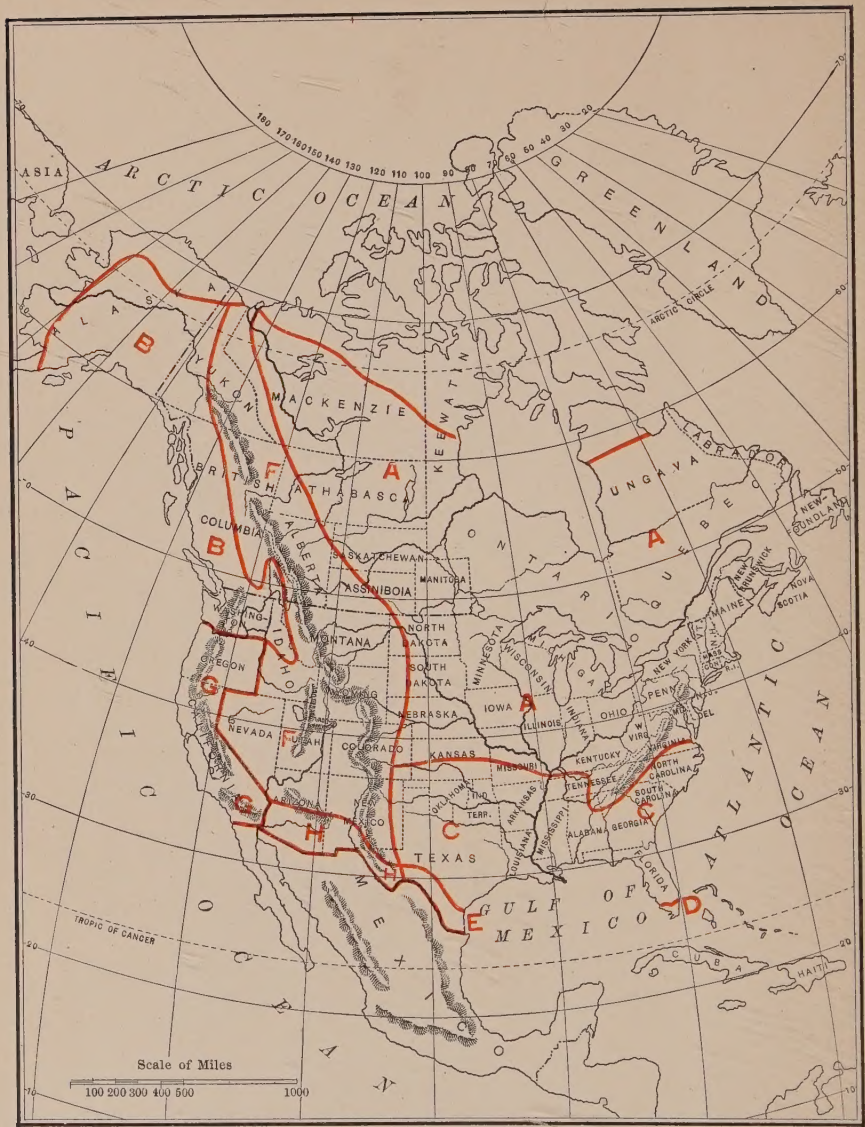

PRINCIPAL TREE REGIONS OF NORTH AMERICA

A North Eastern

B North Western

AB North Eastern & North Western

C South Eastern

D Tropical Florida

E Texas-Mexican Boundary

F Rocky Mountains

G Oregon & California

H New Mexico & Arizona Mexican Boundary

MANUAL OF THE TREES OF NORTH AMERICA

(EXCLUSIVE OF MEXICO)

BY

CHARLES SPRAGUE SARGENT

Director of the Arnold Arboretum of Harvard University
Author of The Silva of North America

WITH SEVEN HUNDRED AND EIGHTY-THREE ILLUSTRATIONS BY

CHARLES EDWARD FAXON

AND

MARY W. GILL

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TO

M. R. S.

THE WISE AND KIND FRIEND OF THIRTY YEARS

THIS BOOK IS DEDICATED

WITH GRATITUDE AND AFFECTION

PREFACE TO THE SECOND EDITION

The studies of the trees of North America (exclusive of Mexico) which have been carried on by the agents and correspondents of the Arboretum in the sixteen years since the publication of the *Manual of the Trees of North America* have increased the knowledge of the subject and made necessary a new edition of this *Manual*. The explorations of these sixteen years have added eighty-nine species of trees and many recently distinguished varieties of formerly imperfectly understood species to the silva of the United States, and made available much additional information in regard to the geographical distribution of American trees. Further studies have made the reduction of seven species of the first edition to varieties of other species seem desirable; and two species, *Amelanchier obovalis* and *Cercocarpus parvifolius*, which were formerly considered trees, but are more properly shrubs, are omitted. The genus Anamomis is now united with Eugenia; and the Arizona *Pinus strobiformis* Sarg. (not Engelm.) is now referred to *Pinus flexilis* James.

Representatives of four Families and sixteen Genera which did not appear in the first edition are described in the new edition in which will be found an account of seven hundred and seventeen species of trees in one hundred and eighty-five genera, illustrated by seven hundred and eighty-three figures, or one hundred and forty-one figures in addition to those which appeared in the first edition.

An International Congress of Botanists which assembled in Vienna in 1905, and again in Brussels in 1910, adopted rules of nomenclature which the world, with a few American exceptions, has now generally adopted. The names used in this new *Manual* are based on the rules of this International Congress. These are the names used by the largest number of the students of plants, and it is unfortunate that the confusion in the names of American trees must continue as long as the Department of Agriculture, including the Forest Service of the United States, uses another and now generally unrecognized system.

The new illustrations in this edition are partly from drawings made by Charles Edward Faxon, who died before his work was finished; it was continued by the skillful pencil of Mary W. Gill, of Washington, to whom I am grateful for her intelligent coöperation.

It is impossible to name here all the men and women who have in the last sixteen years contributed to this account of American trees, and I will now only mention Mr. T. G. Harbison and Mr. E. J. Palmer, who as agents of the Arboretum have studied for years the trees of the Southeastern States and of the Missouri-Texas region, Professor R. S. Cocks, of Tulane University, who has explored carefully and critically the forests of Louisiana, and Miss Alice Eastwood, head of the Botanical Department of the California Academy of Sciences, who has made special journeys in Alaska and New Mexico in the interest of this *Manual*. Mr. Alfred Rehder, Curator of the Herbarium of the Arboretum, has added to the knowledge of our trees in several Southern journeys; and to him I am specially indebted for assistance and advice in the preparation of the keys to the different groups of plants found in this volume.

This new edition of the *Manual* contains the results of forty-four years of my continuous study of the trees of North America carried on in every part of the United States and in many foreign countries. If these studies in any way serve to increase the knowledge and the love of trees I shall feel that these years have not been misspent.

C. S. Sargent.

Arnold Arboretum
September, 1921

PREFACE

In this volume I have tried to bring into convenient form for the use of students the information concerning the trees of North America which has been gathered at the Arnold Arboretum during the last thirty years and has been largely elaborated in my *Silva of North America*.

The indigenous trees of no other region of equal extent are, perhaps, so well known as those that grow naturally in North America. There is, however, still much to be learned about them. In the southern states, one of the most remarkable extratropical regions in the world in the richness of its arborescent flora, several species are still imperfectly known, while it is not improbable that a few may have escaped entirely the notice of botanists; and in the northern states are several forms of Cratægus which, in the absence of sufficient information, it has been found impracticable to include in this volume. Little is known as yet of the silvicultural value and requirements of North American trees, or of the diseases that affect them; and one of the objects of this volume is to stimulate further investigation of their characters and needs.

The arrangement of families and genera adopted in this volume is that of Engler & Prantl's *Die Natürlichen Pflanzenfamilien*, in which the procession is from a simpler to a more complex structure. The nomenclature is that of *The Silva of North America*. Descriptions of a few species of Cratægus are now first published, and investigations made since the publication of the last volume of *The Silva of North America*, in December, 1902, have necessitated the introduction of a few additional trees described by other authors, and occasional changes of names.

An analytical key to the families, based on the arrangement and character of the leaves, will lead the reader first to the family to which any tree belongs; a conspectus of the genera, embodying the important and easily discovered contrasting characters of each genus and following the description of each family represented by more than one genus, will lead him to the genus he is trying to determine; and a similar conspectus of the species, following the description of the genus, will finally bring him to the species for which he is looking. Further to facilitate the determination, one or more letters, attached to the name of the species in the conspectus following the description of the genus, indicate in which of the eight regions into which the country is divided according to the prevailing character of the arborescent vegetation that species grows (see map forming frontispiece of the volume). For example, the northeastern part of the country, including the high Appalachian Mountains in the southern states which have chiefly a northern flora, is represented by (A), and a person wishing to learn the name of a Pine-tree or of an Oak in that region need occupy himself only with those species which in the conspectus of the genus Quercus or Pinus are followed by the letter (A), while a person wishing to determine an Oak or a Pine-tree in Oregon or California may pass over all species which are not followed by (G), the letter which represents the Pacific coast region south of the state of Washington.

The sign of degrees (°) is used in this work to represent feet, and the sign of minutes (′) inches.

The illustrations which accompany each species and important variety are one half the size of nature, except in the case of a few of the large Pine cones, the flowers of some of the

Magnolias, and the leaves and flower-clusters of the Palms. These are represented as less than half the size of nature in order to make the illustrations of uniform size. These illustrations are from drawings by Mr. Faxon, in which he has shown his usual skill and experience as a botanical draftsman in bringing out the most important characters of each species, and in them will be found the chief value of this Manual. For aid in its preparation I am indebted to him and to my other associates, Mr. Alfred Rehder and Mr. George R. Shaw, who have helped me in compiling the most difficult of the keys.

C. S. Sargent.

Arnold Arboretum, Jamaica Plain, Mass.
January, 1905.

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SYNOPSIS

OF THE FAMILIES OF PLANTS DESCRIBED IN THIS BOOK

Class I. GYMNOSPERMÆ.

Resinous trees; stems formed of bark, wood, or pith, and increasing in diameter by the annual addition of a layer of wood inside the bark; flowers unisexual; stamens numerous; ovules and seeds 2 or many, borne on the face of a scale, not inclosed in an ovary; embryo with 2 or more cotyledons; leaves straight-veined, without stipules.

I. **Pinaceæ** (p. 1). Flowers usually monœcious; ovules 2 or several; fruit a woody cone (*in Juniperus berry-like*); cotyledons 2 or many; leaves needle-shaped, linear or scale-like, persistent (*deciduous in Larix and Taxodium*).

II. **Taxaceæ** (p. 90). Flowers diœcious, axillary, solitary; ovules 1; fruit surrounded by or inclosed in the enlarged fleshy aril-like disk of the flower; cotyledons 2; leaves linear, alternate, persistent.

Class II. ANGIOSPERMÆ.

Carpels or pistils consisting of a closed cavity containing the ovules and becoming the fruit.

Division I. MONOCOTYLEDONES.

Stems with woody fibres distributed irregularly through them, but without pith or annual layers of growth; parts of the flower in 3's; ovary superior, 3-celled; embryo with a single cotyledon; leaves parallel-veined, persistent, without stipules.

III. **Palmæ** (p. 96). Ovule solitary; fruit baccate or drupaceous, 1 or rarely 2 or 3-seeded; leaves alternate, pinnate, flabellate or orbicular, persistent.

IV. **Liliaceæ** (p. 110). Ovules numerous in each cell; fruit 3-celled, capsular or baccate; leaves linear-lanceolate.

Division II. DICOTYLEDONES.

Stems formed of bark, wood, and pith, and increasing by the addition of an annual layer of wood inside the bark; parts of the flower mostly in 4's or 5's; embryo with a pair of opposite cotyledons; leaves netted-veined.

Subdivision 1. Apetalæ. Flowers without a corolla and sometimes without a calyx.

Section 1. Flowers in unisexual aments (*female flowers of Juglans and Quercus solitary or in spikes*); ovary inferior (*superior in Leitneriaceæ*) when a calyx is present.

V. **Salicaceæ** (p. 119). Flowers diœcious, without a calyx. Fruit a 2–4-valved capsule. Leaves simple, alternate, with stipules, deciduous.

VI. **Myricaceæ** (p. 163). Flowers monœcious or diœcious; fruit a dry drupe, covered with waxy exudations; leaves simple, alternate, resinous-punctate, persistent.

VII. **Leitneriaceæ** (p. 167). Flowers diœcious, the staminate without a calyx; ovary superior; fruit a compressed oblong drupe; leaves alternate, simple, without stipules, deciduous.

VIII. **Juglandaceæ** (p. 168). Flowers monœcious; fruit a nut inclosed in an indehiscent (Juglans) or 4-valved (Carya) fleshy or woody shell; leaves alternate, unequally pinnate without stipules, deciduous.

IX. **Betulaceæ** (p. 200). Flowers monœcious; fruit a nut at the base of an open leaf-like involucre (Carpinus), in a sack-like involucre (Ostrya), in the axil of a scale of an ament (Betula), or of a woody strobile (Alnus); leaves alternate, simple, with stipules, deciduous.

X. **Fagaceæ** (p. 227). Flowers monœcious; fruit a nut more or less inclosed in a woody often spiny involucre; leaves alternate, simple, with stipules, deciduous (*in some species of Quercus and in Castanopsis and Lithocarpus persistent*).

Section 2. Flowers unisexual (*perfect in Ulmus*); calyx regular, the stamens as many as its lobes and opposite them; ovary superior, 1-celled; seed 1.

XI. **Ulmaceæ** (p. 308). Fruit a compressed winged samara (Ulmus), a drupe (Celtis and Trema), or nut-like (Planera), leaves simple, alternate, with stipules, deciduous (*persistent in Trema*).

XII. **Moraceæ** (p. 328). Flowers in ament-like spikes or heads; fruit drupaceous, inclosed in the thickened calyx and united into a compound fruit, oblong and succulent (Morus), large, dry and globose (Toxylon), or immersed in the fleshy receptacle of the flower (Ficus); leaves simple, alternate, with stipules, deciduous (*persistent in Ficus*).

Section 3. Flowers usually perfect; ovary superior or partly inferior, 1-4celled; leaves simple, persistent in the North American species.

XIII. **Olacaceæ** (p. 336). Calyx and corolla 4–6-lobed; ovary 1–4-celled; fruit a drupe more or less inclosed in the enlarged disk of the flower; leaves alternate or fascicled, without stipules.

XIV. **Polygonaceæ** (p. 338). Calyx 5-lobed; ovary 1-celled; fruit a nutlet inclosed in the thickened calyx; leaves alternate, their stipules sheathing the stems.

XV. **Nyctaginaceæ** (p. 340). Calyx 5-lobed; ovary 1-celled; fruit a nutlet inclosed in the thickened calyx; leaves alternate or opposite, without stipules.

Subdivision 2. Petalatæ. Flowers with both calyx and corolla (*without a corolla in Lauraceæ, in Liquidambar in Hamamelidaceæ, in Cercocarpus in Rosaceæ, in Euphorbiaceæ, in some species of Acer, in Reynosia, Condalia, and Krugiodendron in Rhamnaceæ, in Fremontia in Sterculiaceæ, in Chytraculia in Myrtaceæ, in Conocarpus in Combretaceæ and in some species of Fraxinus in Oleaceæ*).

Section 1. Polypetalæ. Corolla of separate petals.

A. Ovary superior (*partly inferior in Hamamelidaceæ; inferior in Malus, Sorbus, Heteromeles, Cratægus, and Amelanchier in Rosaceæ*).

XVI. **Magnoliaceæ** (p. 342). Flowers perfect; sepals and petals in 3 or 4 rows of 3 each; fruit cone-like, composed of numerous cohering carpels; leaves simple, alternate, their stipules inclosing the leaf-buds, deciduous or rarely persistent.

XVII. **Annonaceæ** (p. 353). Flowers perfect; sepals 3; petals 6 in 2 series; fruit a pulpy berry developed from 1 or from the union of several carpels; leaves simple, alternate, without stipules, deciduous or persistent.

XVIII. **Lauraceæ** (p. 356). Flowers perfect or unisexual; corolla 0; fruit a 1-seeded drupe or berry; leaves simple, alternate, punctate, without stipules, persistent (*deciduous in Sassafras*).

XIX. **Capparidaceæ** (p. 365). Flowers perfect; sepals and petals 4; fruit baccate, elongated, dehiscent; leaves alternate, simple, without stipules, persistent.

XX. **Hamamelidaceæ** (p. 366). Flowers perfect or unisexual; sepals and petals 5 (*corolla 0 in Liquidambar*); ovary partly inferior; fruit a 2-celled woody capsule opening at the summit; leaves simple, alternate, with stipules, deciduous.

XXI. **Platanaceæ** (p. 371). Flowers monœcious, in dense unisexual capitate heads; fruit an akene; leaves simple, alternate, with stipules, deciduous.

XXII. **Rosaceæ** (p. 376). Flowers perfect; sepals and petals 5 (petals 0 in Cercocarpus); ovary inferior in Malus, Sorbus, Heteromeles, Cratægus, and Amelanchier; fruit a drupe (Prunus and Chrysobalanus), a capsule (Vauquelinia and Lyonothamnus), an akene (Cowania and Cercocarpus), or a pome (Malus, Sorbus, Heteromeles, Cratægus, and Amelanchier); leaves simple or pinnately compound, alternate (*opposite in Lyonothamnus*), with stipules, deciduous or persistent.

XXIII. **Leguminosæ** (p. 585). Flowers perfect, regular or irregular; fruit a legume; leaves compound, or simple (Dalea), alternate, with stipules, deciduous or persistent.

XXIV. **Zygophyllaceæ** (p. 630). Flowers perfect; calyx 5-lobed; petals 5; fruit capsular, becoming fleshy; leaves opposite, pinnate, with stipules, persistent.

XXV. **Malpighiaceæ** (p. 631). Flowers usually perfect rarely dimorphous; calyx 5-lobed; petals 5, unguiculate; fruit a drupe or samara; leaves opposite, simple, entire, persistent; often with stipules.

XXVI. **Rutaceæ** (p. 633). Flowers unisexual or perfect; fruit a capsule (Xanthoxylum), a samara (Ptelea), of indehiscent winged 1-seeded carpels (Helietta), or a drupe (Amyris); leaves alternate or opposite, compound, glandular-punctate, without stipules, persistent or rarely deciduous (*0 in Canotia*).

XXVII. **Simaroubaceæ** (p. 641). Flowers dicœcious, calyx 5-lobed; petals 5; fruit drupaceous (Simarouba), baccate (Picramnia), a samara (Alvaradoa); leaves alternate, equally pinnate, without stipules, persistent.

XXVIII. **Burseraceæ** (p. 645). Flowers perfect; calyx 4 or 5-parted; petals 5; fruit a drupe; leaves alternate, compound, without stipules, deciduous.

XXIX. **Meliaceæ** (p. 648). Flowers perfect; calyx 5-lobed; petals 5; fruit a 5-celled dehiscent capsule; leaves alternate, equally pinnate, without stipules, persistent.

XXX. **Euphorbiaceæ** (p. 649). Flowers perfect; calyx 4–6-parted (Drypetes), 3-lobed (Hippomane), or 0 (Gymnanthes); petals 0; fruit a drupe (Drypetes and Hippomane), or a 3-lobed capsule (Gymnanthes).

XXXI. **Anacardiaceæ** (p. 655). Flowers usually unisexual, dicœcious or polygamo-dicœcious (*Pistacia without a calyx, and without a corolla in the North American species*); fruit a dry drupe; leaves simple or compound, alternate, without stipules, deciduous (*persistent in Pistacia and in one species of Rhus*).

XXXII. **Cyrillaceæ** (p. 665). Flowers perfect; calyx 5–8-lobed; petals 5–8; fruit an indehiscent capsule; leaves alternate, without stipules, persistent (*more or less deciduous in Cyrilla*).

XXXIII. **Aquifoliaceæ** (p. 668). Flowers polygamo-dicœcious; calyx 4 or 5-lobed; petals 5; fruit a drupe, with 4–8 1-seeded nutlets; leaves alternate, simple, with stipules, persistent or deciduous.

XXXIV. **Celastraceæ** (p. 674). Flowers perfect, polygamous or dicœcious; calyx 4 or 5-lobed; petals 4 or 5; fruit a drupe, or a capsule (Evonymus); leaves simple, opposite or alternate, with or without stipules, persistent (*deciduous in Evonymus*).

XXXV. **Aceraceæ** (p. 681). Flowers dicœcious or monœciously polygamous; calyx usually 5-parted; petals usually 5, or 0; fruit of 2 long-winged samara joined at the base; leaves opposite, simple or rarely pinnate, without or rarely with stipules, deciduous.

XXXVI. **Hippocastanaceæ** (p. 702). Flowers perfect, irregular; calyx 5-lobed; petals 4 or 5, unequal; fruit a 3-celled 3-valved capsule; leaves opposite, digitately compound, long-petiolate, without stipules, deciduous.

XXXVII. **Sapindaceæ** (p. 711). Flowers polygamous; calyx 4 or 5-lobed; corolla of 4 or 5 petals; fruit a berry (Sapindus and Exothea), a drupe (Hypelate), or a 3-valved capsule (Ungnadia); leaves alternate, compound, without stipules, persistent, or deciduous (Ungnadia).

XXXVIII. **Rhamnaceæ** (p. 718). Flowers usually perfect; calyx 4 or 5-lobed; petals 4 or 5 (*0 in Reynosia, Condalia, and Krugiodendron*); fruit drupaceous; leaves simple, alternate (*mostly opposite in Reynosia and Krugiodendron*), with stipules, persistent (*deciduous in some species of Rhamnus*).

XXXIX. **Tiliaceæ** (p. 732). Flowers perfect; sepals and petals 5; fruit a nut-like berry; leaves simple, alternate, mostly oblique at base, with stipules, deciduous.

XL. **Sterculiaceæ** (p. 749). Flowers perfect; calyx 5-lobed; petals 0; fruit a 4 or 5-valved dehiscent capsule; leaves simple, alternate, with stipules, persistent.

XLI. **Theaceæ** (p. 750). Flowers perfect; sepals and petals 5; fruit a 5-celled woody dehiscent capsule, loculicidally dehiscent; leaves simple, alternate, without stipules, persistent or deciduous.

XLII. **Canellaceæ** (p. 753). Flowers perfect; sepals 3; petals 5; filaments united into a tube; fruit a berry; leaves simple, alternate, without stipules, persistent.

XLIII. **Kœberliniaceæ** (p. 754). Flowers perfect; sepals and petals 4, minute; leaves bract-like, alternate, without stipules, caducous.

XLIV. **Caricaceæ** (p. 755). Flowers unisexual or perfect; calyx 5-lobed; petals 5; fruit baccate; leaves palmately lobed or digitate, alternate, without stipules, persistent.

B. Ovary inferior (*partly inferior in Rhizophora*).

XLV. **Cactaceæ** (p. 757). Flowers perfect; petals and sepals numerous; fruit a berry; leaves usually wanting.

XLVI. **Rhizophoraceæ** (p. 763). Flowers perfect; calyx 4-parted; petals 4; ovary partly inferior; fruit a 1-celled 1-seeded berry perforated at apex by the germinating embryo; leaves simple, opposite, entire, with stipules, persistent.

XLVII. **Combretaceæ** (p. 764). Flowers perfect or polygamous; calyx 5-lobed; petals 5 (*0 in Conocarpus*); fruit drupaceous; leaves simple, alternate or opposite, without stipules, persistent.

XLVIII. **Myrtaceæ** (p. 768). Flowers perfect; calyx usually 4-lobed, or reduced to a single body forming a deciduous lid to the flower (Chytraculia); petals usually 4 (*0 in Chytraculia*); fruit a berry; leaves simple, opposite, pellucid-punctate, without stipules, persistent.

XLIX. **Melastomaceæ** (p. 776). Flowers perfect; calyx and corolla 4 or 5-lobed; stamens as many or twice as many as the lobes of the corolla; fruit capsular or baccate, inclosed in the tube of the calyx; leaves opposite, rarely verticillate, 3–9-nerved, without stipules.

L. **Araliaceæ** (p. 777). Flowers perfect or polygamous; sepals and petals usually 5; fruit a drupe; leaves twice pinnate, alternate, with stipules, deciduous.

LI. **Nyssaceæ** (p. 779). Flowers dicœcious, polygamous, dicœcious or perfect; calyx 5-toothed or lobed; petals 5 or more, imbricate in the bud, or 0; stamens as many or twice as many as the petals; fruit drupaceous (Nyssa), usually 1-celled and 1-seeded; leaves alternate, deciduous, without stipules.

LII. **Cornaceæ** (p. 784). Flowers perfect or polygamo-dicœcious; calyx 4 or 5-toothed; petals 4 or 5; fruit a fleshy drupe; leaves simple, opposite (*alternate in one species of Cornus*), without stipules, deciduous.

Section 2. GAMOPETALÆ. Corolla of united petals (*divided in Elliottia in Ericaceæ, 0 in some species of Fraxinus in Oleaceæ*).

A. OVARY SUPERIOR (*inferior in Vaccinium in Ericaceæ, partly inferior in Symplocaceæ and Styracaceæ*).

LIII. **Ericaceæ** (p. 790). Flowers perfect; calyx and corolla 5-lobed (*in Elliottia corolla of 4 petals*); (*ovary inferior in Vaccinium*); fruit capsular, drupaceous or baccate; leaves simple, alternate, without stipules, persistent (*deciduous in Elliottia and Oxydendrum*).

LIV. **Theophrastaceæ** (p. 804). Flowers perfect, with staminodia; sepals and petals 5; stamens 5; fruit a berry; leaves simple, opposite or alternate, entire, without stipules.

LV. **Myrsinaceæ** (p. 805). Flowers perfect; calyx and corolla 5-lobed; stamens 5; fruit a drupe; leaves simple, alternate, entire, without stipules, persistent.

LVI. **Sapotaceæ** (p. 808). Flowers perfect; calyx 5-lobed; corolla 5-lobed (*6-lobed in Mimusops*), often with as many or twice as many internal appendages borne on its throat; fruit a berry; leaves simple, alternate, without stipules, persistent (*deciduous in some species of Bumelia*).

LVII. **Ebenaceæ** (p. 820). Flowers perfect, dicœcious, or polygamous; calyx and corolla 4-lobed; fruit a 1 or several-seeded berry; leaves simple, alternate, entire, without stipules, deciduous.

LVIII. **Styracaceæ** (p. 824). Flowers perfect; calyx 4 or 5-toothed; corolla 4 or 5-lobed or divided nearly to the base, or rarely 6 or 7-lobed; ovary superior or partly superior; fruit a drupe; leaves simple, alternate, without stipules, deciduous; pubescence mostly scurfy or stellate.

LIX. **Symplocaceæ** (p. 830). Flowers perfect; calyx and corolla 5-lobed; ovary inferior or partly inferior; fruit a drupe; leaves simple, alternate, without stipules, deciduous; pubescence simple.

LX. **Oleaceæ** (p. 832). Flowers perfect or polygamo-dicœcious; calyx 4-lobed (*0 in some species of Fraxinus*); corolla 2–6-parted (*0 in some species of Fraxinus*); fruit a winged samara (Fraxinus) or a fleshy drupe (Forestiera, Chionanthus and Osmanthus); leaves pinnate (Fraxinus) or simple, opposite, without stipules, deciduous (*persistent in Osmanthus*).

LXI. **Borraginaceæ** (p. 858). Flowers perfect or polygamous; calyx and corolla 5-lobed; fruit a drupe; leaves simple, alternate, scabrous-pubescent, without stipules, persistent or tardily deciduous.

LXII. **Verbenaceæ** (p. 864). Flowers perfect; calyx 5-lobed; corolla 4 or 5-lobed; fruit a drupe or a 1-seeded capsule; leaves simple, opposite, without stipules, persistent.

LXIII. **Solanaceæ** (p. 867). Flowers perfect; calyx campanulate, usually 5-lobed; corolla usually 5-lobed; fruit baccate, surrounded at base by the enlarged calyx; leaves alternate, rarely opposite, without stipules.

LXIV. **Bignoniaceæ** (p. 868). Flowers perfect; calyx bilabiate; corolla bilabiate, 5-lobed; fruit a woody capsule (Catalpa and Chilopsis) or a berry (Enallagma); leaves simple, opposite (*sometimes alternate in Chilopsis*), without stipules, deciduous (*persistent in Enallagma*).

B. Ovary inferior (*partly superior in Sambucus in Caprifoliaceæ*).

LXV. **Rubiaceæ** (p. 875). Flowers perfect; calyx and corolla 4 or 5-lobed; fruit a capsule (Exostema and Pinckneya), a drupe (Guettarda), or nut-like (Cephalanthus); leaves simple opposite, or in verticils of 3 (Cephalanthus), with stipules, persistent (*deciduous in Pinckneya and Cephalanthus*).

LXVI. **Caprifoliaceæ** (p. 882). Flowers perfect; calyx and corolla 5-lobed; fruit a drupe; leaves unequally pinnate (Sambucus) or simple (Viburnum), opposite, without stipules, deciduous in North American species.

ANALYTICAL KEY

TO THE GENERA OF PLANTS INCLUDED IN THIS BOOK, BASED CHIEFLY ON THE CHARACTER OF THE LEAVES

I. Leaves parallel-veined, alternate, persistent, clustered at the end of the stem or branches. Monocotyledones.

Stem simple; leaves stalked.

Leaves fan-shaped.

Leaf stalks unarmed.

Rachis short; leaves usually silvery white below.

Leaves 2°–4° in diameter (*green below in No. 2*), their segments undivided at apex. **Thrinax** (p. 96).

Leaves 18′–24′ in diameter, their segments divided at apex. **Coccothrinax** (p. 100).

Rachis elongated; leaves green below, their segments divided at apex. **Sabal** (p. 101).

Leaf stalks armed with marginal teeth or spines.

Leaf stalks furnished irregularly with broad thin large and small, straight or hooked spines confluent into a thin bright orange-colored cartilaginous margin; leaves longer than wide, divided nearly to the middle into segments parted at apex and separating on the margins into thin fibres. **Washingtonia** (p. 104).

Leaf stalks furnished with stout or slender flattened teeth; leaves suborbicular, divided to the middle or nearly to the base into segments parted at apex; segments of the blade not separating on the margin into thin fibres. **Acœlorraphe** (p. 105).

Leaves pinnate.

Leaves 10°–12° in length, their pinnæ 2½°–3° long and often 1½° wide, deep green. **Roystonea** (p. 107).

Leaves 5°–6° long, their pinnæ 18′ long and 1′ wide, dark yellow-green above, pale and glaucous below. **Pseudophœnix** (p. 109).

Stem simple or branched; leaves sessile, lanceolate, long- and usually sharp-pointed at apex. **Yucca** (p. 110).

II. Leaves 1-nerved, needle-shaped, linear or scale-like, persistent (deciduous in Larix and Taxodium). Gymnospermæ.

1. Leaves Persistent.

a Leaves fascicled, needle-shaped, in 1–5-leafed clusters enclosed at base in a membranaceous sheath. **Pinus** (p. 2).

aa Leaves scattered, usually linear.

b Leaves linear, often obtuse or emarginate.

Base of the leaves persistent on the branches.

Leaves sessile, 4-sided, or flattened and stomatiferous above. **Picea** (p. 34).

Leaves stalked, flattened and stomatiferous below, or angular, often appearing 2-ranked. **Tsuga** (p. 42).

Base of the leaves not persistent on the branches; leaves often appearing 2-ranked.

Leaves stalked, flattened, stomatiferous below; winter-buds pointed, not resinous. **Pseudotsuga** (p. 47).

Leaves sessile, flattened and often grooved on the upper side, or quadrangular, rarely stomatiferous above, on upper fertile branches often crowded; winter-buds obtuse, resinous (*except in No. 9*). **Abies** (p. 50).

bb Leaves linear-lanceolate, rigid, acuminate, spirally disposed, appearing 2-ranked by a twist in the petiole.

Leaves abruptly contracted at base, long-pointed, with pale bands of stomata on the lower surface on each side of the midveins; fruit drupelike. **Torreya** (p. 91).

Leaves gradually narrowed at base, short-pointed, paler, and without distinct bands of stomata on the lower surface; fruit berry-like. **Taxus** (p. 93).

bbb Leaves ovate-lanceolate and scale-like, spreading in 2 ranks or linear on the same tree, acute, compressed, keeled on the back and closely appressed or spreading at apex. **Sequoia** (p. 61).

aaa Leaves opposite or whorled, usually scale-like.

Internodes distinctly longer than broad; branchlets flattened, of nearly equal color on both sides; leaves eglandular. **Libocedrus** (p. 65).

Internodes about as long as broad, often pale below, usually glandular.

Branchlets flattened.

Branchlets in one plane, much flattened, $\frac{1}{12}'$–$\frac{1}{6}'$ broad. **Thuja** (p. 67).

Branchlets slightly flattened, $\frac{1}{24}'$–$\frac{1}{16}'$ broad. **Chamæcyparis** (p. 75).

Branchlets terete or 4-angled.

Branchlets more or less in one plane; fruit a cone. **Cupressus** (p. 69).

Branchlets not in one plane; fruit a berry (*leaves needle-shaped, in whorls of 3 in No. 1*). **Juniperus** (p. 78).

2. Leaves Deciduous.

Leaves in many-leafed clusters on short lateral spurs. **Larix** (p. 31).

Leaves spreading in 2 ranks. **Taxodium** (p. 63).

III. Leaves netted-veined, rarely scale-like or wanting. Dicotyledones.

A. LEAVES OPPOSITE. (B, see p. xxi).

1. Leaves Simple. (2, see p. xx).

* Leaves persistent.

a Leaves with stipules.

b Leaves entire or occasionally slightly crenate or serrate.

c Leaves emarginate at apex, very short-stalked, $1\frac{1}{2}'$–$2'$ long.

Leaves obovate, gradually narrowed into the petiole. **Gyminda** (p. 678).

Leaves oval to oblong, rounded or broad-cuneate (*rarely alternate*).

Branchlets densely velutinous. **Krugiodendron** (p. 721).

Branchlets slightly puberulous at first, soon glabrous. **Reynosia** (p. 720).

cc Leaves not emarginate at apex.

Leaves obtuse, rarely acutish or abruptly short-pointed.

Leaves elliptic, $3\frac{1}{2}'$–$5'$ long. **Rhizophora** (p. 763).

Leaves obovate, usually rounded at apex, $\frac{3}{4}'$–$2'$ long. **Byrsonima** (p. 632).

Leaves acute to acuminate.

Leaves oblong-ovate to lanceolate; branchlets glabrous. **Exostema** (p. 877).

Leaves broad-elliptic to oblong-elliptic; branchlets villose. **Guettarda** (p. 879).

bb Leaves serrate (*often pinnate*). **Lyonothamnus** (p. 378).

aa Leaves without stipules.

Petioles biglandular; leaves obtuse or emarginate, $1\frac{1}{2}'$–$2\frac{1}{2}'$ long. **Laguncularia** (p. 767).

Petioles without glands.

Leaves furnished below with small dark glands, slightly aromatic; petioles short.

Leaves oblong to oblong-ovate and acuminate or elliptic and bluntly short-pointed. **Calyptranthes** (p. 769).

Leaves ovate, obovate or elliptic. **Eugenia** (p. 770).

Leaves without glands.

Leaves green and glabrous below.
Leaves obtuse or emarginate at apex (*rarely alternate*), 1′–1½′ long. **Torrubia** (p. 341).
Leaves acute, acuminate, or sometimes rounded or emarginate, 3′–5′ long.
Leaves distinctly veined. **Citharexylon** (p. 864).
Leaves obscurely veined. **Osmanthus** (p. 856).
Leaves hoary tomentulose or scurfy below.
Leaves strongly 3-nerved, acuminate, densely scurfy below. **Tetrazygia** (p. 776).
Leaves penniveined, rounded or acute at apex, hoary tomentulose below. **Avicennia** (p. 865).

** Leaves deciduous.

a Leaves without lobes.
b Leaves serrate.
Winter-buds with several opposite outer scales.
Leaves puberulous below, closely and finely serrate; axillary buds solitary. **Evonymus** (p. 675).
Leaves glabrous below, remotely crenate-serrulate; axillary buds several, superposed. **Forestiera** (p. 853).
Winter-buds enclosed in 2 large opposite scales. **Viburnum** (p. 886).
bb Leaves entire.
c Leaves without stipules.
Leaves suborbicular or elliptic to oblong.
Leaves rounded or acutish at apex, 1′–2′ long, occasionally 3-foliolate, glabrous; branchlets quadrangular. **Fraxinus anomala** (p. 837).
Leaves acuminate or acute at apex, 3′–4′ long.
Leaf-scars connected by a transverse line, with 3 bundle-traces; branchlets slender, appressed-pubescent. **Cornus** (p. 785).
Leaf-scars not connected, with 1 bundle-trace; branchlets stout, villose, puberulous or glabrous. **Chionanthus** (p. 855).
Leaves broad-ovate, cordate, acuminate, 5′–12′ long, on long petioles. **Catalpa** (p. 870).
Leaves linear to linear-lanceolate, short-stalked or sessile (*sometimes alternate*). **Chilopsis** (p. 869).
cc Leaves with persistent stipules, entire.
Leaves oval or ovate; winter-buds resinous, the terminal up to ½′ in length. **Pinckneya** (p. 876).
Leaves ovate to lanceolate; winter-buds minute. **Cephalanthus** (p. 878).
aa Leaves palmately lobed. **Acer** (p. 681).

2. Leaves Compound.

a Leaves persistent, with stipules.
Leaves equally pinnate; leaflets entire. **Guaiacum** (p. 630).
Leaves unequally pinnately parted into 3–8 linear-lanceolate segments (*sometimes entire*). **Lyonothamnus** (p. 378).
Leaves trifoliate.
Leaflets stalked. **Amyris** (p. 640).
Leaflets sessile. **Helietta** (p. 637).
aa Leaves deciduous.
Leaves unequally pinnate or trifoliate.
Leaflets crenate-serrate or entire, the veins arching within the margins; stipules wanting; winter-buds with several opposite scales. **Fraxinus** (p. 833).
Leaflets sharply or incisely serrate, the primary veins extending to the teeth.
Leaflets 3–7, incisely serrate; stipules present; winter-buds with 1 pair of obtuse outer scales. **Acer Negundo** (p. 699).
Leaflets 5–9, sharply serrate; stipules present; winter-buds with many opposite acute scales; pith thick. **Sambucus** (p. 882).
Leaves digitate, with 5–7, sharply serrate leaflets; terminal buds large. **Æsculus** (p. 702).

B. LEAVES ALTERNATE.

1. Leaves Simple. (2, see p. xxvi).

* Leaves persistent. (** see p. xxiv).

a Leaves deeply 3–5-lobed, $\frac{1}{3}'$–$\frac{1}{2}'$ long, with linear lobes, hoary tomentose below. **Cowania** (p. 549).

aa Leaves palmately lobed.

Leaves stellate-pubescent, about $1\frac{1}{2}'$ in diameter, with stipules. **Fremontia** (p. 749).

Leaves glabrous, 1°–2° in diameter, without stipules. **Carica** (p. 755).

aaa Leaves not lobed or pinnately lobed.

b Branches spinescent.

Leaves clustered at the end of the branches, at least 2′–3′ long. **Bucida** (p. 765).

Leaves fascicled on lateral branchlets, obtuse or emarginate, pale and glabrous beneath. **Bumelia angustifolia** (p. 816).

Leaves scattered.

Leaves generally obovate, mucronate, not more than $\frac{1}{2}'$–1′ long, glabrous and green or brownish tomentulose beneath. **Condalia** (p. 719).

Leaves elliptic-ovate to oblong, obtuse or emarginate, glabrous, 1–2 cm. long. **Ximenia** (p. 337).

bb Branches not spinescent.

c Leaves serrate, or lobed (*in some species of Quercus*). (*cc*, see p. xxii.)

d Juice watery. (*dd*, see p. xxii.)

e Stipules present. (*ee*, see p. xxii.)

f Primary veins extending straight to the teeth.

Leaves and branchlets glabrous or pubescent to tomentose with fascicled hairs.

Leaves fulvous-tomentose beneath, repand-dentate, 3′–5′ long. **Lithocarpus** (p. 236).

Leaves glabrous or grayish to whitish tomentose beneath, entire, lobed or dentate. **Quercus sp.** 21–34 (p. 268).

Leaves and branchlets coated with simpled silky or woolly hairs at least while young, not more than $2\frac{1}{2}'$ long. **Cercocarpus** (p. 550).

ff Primary veins arching and united within the margin.

Leaves 3-nerved from the base. **Ceanothus** (p. 726).

Leaves not 3-nerved.

Leaves acute.

Leaves sinuately dentate, with few spiny teeth (*rarely entire*), glabrous. **Ilex opaca** (p. 669).

Leaves serrate.

Leaves tomentose below; branchlets tomentose.

Leaves narrow-lanceolate, glabrous and smooth above. **Vauquelinia** (p. 377).

Leaves ovate, cordate, scabrate above. **Trema** (p. 327).

Leaves glabrous below. **Heteromeles** (p. 392).

Leaves entire, very rarely toothed.

Leaves elliptic, glabrous. **Prunus caroliniana** (p. 579).

Leaves oblanceolate, pubescent beneath when young. **Ilex Cassine** (p. 670).

Leaves obtuse, sometimes mucronate.

Leaves spinose-serrate, glabrous.

Leaves broad-ovate to suborbicular or elliptic; branchlets dark red-brown, spinescent. **Rhamnus crocea** (p. 723).

Leaves ovate to ovate-lanceolate; branchlets yellow or orange-colored, not spinescent. **Prunus ilicifolia** (p. 581).

Leaves crenate (*often entire*), oval to oblong. **Ilex vomitoria** (p. 671).

ee Stipules wanting.
Leaves resinous-dotted, aromatic, 1½′–4′ long. **Myrica** (p. 163).
Leaves not resinous-dotted, crenately serrate, 4′–6′ long.
Leaves dark green, glabrous below. **Gordonia Lasianthus** (p. 751).
Leaves yellowish green, pubescent below, sometimes nearly entire. **Symplocos** (p. 831).

dd Juice milky.
Petioles 2½′–4′ long; leaves broad-ovate. **Hippomane** (p. 652).
Petioles about ¼′ long; leaves elliptic to oblong-lanceolate. **Gymnanthes** (p. 654).

cc Leaves entire (*rarely sparingly toothed on vigorous branchlets*).
d Stipules present.
e Stipules connate, at least at first.
Stipules persistent, forming a sheath surrounding the branch above the node; leaves obtuse. **Coccolobis** (p. 338).
Stipules deciduous, enveloping the unfolded leaf.
Leaves ferrugineous-tomentose beneath. **Magnolia grandiflora** (p. 345).
Leaves glabrous beneath, with milky juice. **Ficus** (p. 333).
ee Stipules free.
f Juice milky; leaves oval to oblong, 3′–5′ long. **Drypetes** (p. 650).
ff Juice watery.
g Leaves obtuse or emarginate at apex.
Leaves with ferrugineous scales beneath, their petioles slender. **Capparis** (p. 365).
Leaves without ferrugineous scales.
Leaves soft-pubescent on both sides. **Colubrina cubensis** (p. 730).
Leaves glabrous at least at maturity.
Leaves rarely 2′–3′ long, standing on the branch at acute angles. **Chrysobalanus** (p. 583).
Leaves rarely more than 1′ long, spreading (sometimes 3-nerved). **Ceanothus spinosus** (p. 728).
gg Leaves acute or acutish.
Petioles with 2 glands. **Conocarpus** (p. 766).
Petioles without glands.
Leaves and branchlets more or less pubescent, at least while young.
Leaves fascicled except on vigorous branchlets. **Cercocarpus** (p. 550).
Leaves not fascicled.
Winter-buds minute, with few pointed scales.
Leaves rounded or nearly rounded at base. **Colubrina sp.** 1, 3 (p. 729).
Leaves broad-cuneate at base. **Ilex Cassine** (p. 670).
Winter-buds conspicuous, with numerous scales.
Leaves usually lanceolate, entire, covered below with yellow scales. **Castanopsis** (p. 234).
Leaves oblong or oblong-obovate, repand-dentate, fibrous tomentose below. **Lithocarpus** (p. 236).
Leaves and branchlets glabrous.
Leaf-scar with 1 bundle-trace. **Ilex Krugiana** (p. 672).
Leaf-scar with 3 bundle-traces. Cherry Laurels. **Prunus sp.** 19–22 (p. 579).

dd Stipules wanting.
e Leaves aromatic when bruised.
Leaves resinous-dotted. **Myrica** (p. 163).
Leaves not resinous-dotted.
Leaves obtuse, obovate, glabrous. **Canella** (p. 753).
Leaves acute.

Leaves mostly rounded at the narrowed base, ovate to oblong, acute, glabrous. **Annona** (p. 354).
Leaves more or less cuneate at base, elliptic to lanceolate, usually acuminate.
Leaves abruptly long-acuminate, glabrous, the margin undulate; branchlets red-brown. **Misanteca** (p. 364).
Leaves gradually acuminate or nearly acute.
Leaves strongly reticulate beneath.
Branchlets glabrous, light grayish brown; leaves glabrous, light green beneath. **Ocotea** (p. 359).
Branchlets pubescent while young, greenish or yellowish; leaves pale beneath, pubescent while young. **Umbellularia** (p. 360).
Leaves not or slightly reticulate, glaucous, glabrous or pubescent beneath. **Persea** (p. 356).

ee Leaves not aromatic.
f Leaves acute or acutish.
Leaves obovate, gradually narrowed into short petioles.
Leaves 2′–2½′ long. **Schæfferia** (p. 679).
Leaves at least 6′–8′ long. **Enallagma** (p. 873).
Leaves elliptic to oblong or ovate.
Leaves rough or pubescent above, pubescent below, subcordate to cuneate at base.
Leaves stellate-pubescent. **Solanum** (p. 867).
Leaves scabrous above.
Petiole ⅛′–¼′ long; leaves oval or oblong, 1¼′–4′ long. **Ehretia** (p. 862).
Petiole 1′–1½′ long; leaves ovate to oblong-ovate, 3′–7′ long. **Cordia** (p. 858).
Leaves smooth above.
Winter-buds scaly.
Leaves covered below with ferrugineous or pale scales, 1′–3′ long. **Lyonia** (p. 797).
Leaves glabrous or nearly so below.
Leaves ovate-lanceolate or obovate-lanceolate, 4′–12′ long, usually clustered at end of branchlet, veinlets below obscure. **Rhododendron** (p. 792).
Leaves elliptic or oval to oblong or lanceolate.
Leaves light yellowish green below and without distinctly visible veins or veinlets, entire, 3′–4′ long. **Kalmia** (p. 794).
Leaves pale below and more or less distinctly reticulate, occasionally serrate or denticulate, 1′–5′ long; bark of branches red. **Arbutus** (p. 799).
Winter-buds naked.
Leaves pubescent below when unfolding.
Mature leaves nearly glabrous below.
Leaves oblong-lanceolate to narrow-obovate. **Dipholis** (p. 810).
Leaves oval. **Sideroxylum** (p. 809).
Mature leaves covered below with brilliant copper-colored pubescence.
Leaves glabrous below. **Chrysophyllum** (p. 817).
Leaves marked by minute black dots, ovate to oblong-lanceolate. **Ardisia** (p. 806).
Leaves lepidote, oblong-obovate. **Rapanea** (p. 807).

ff Leaves obtuse or emarginate at apex.
g Leaves rounded or cordate at base, emarginate, their petioles slender.
Leaves reniform to broad-ovate, cordate; juice watery. **Cercis** (p. 603).

Leaves elliptic to oblong, rounded at base; juice milky or viscid.
Leaves emarginate; petioles slender, rufous-tomentulose. **Mimusops** (p. 819).
Leaves obtuse at apex; petioles stout, grayish-tomentulose or glabrous. **Rhus integrifolia** (p. 664).
gg Leaves cuneate at base.
Petioles slender, $\frac{1}{2}'$ long. **Beureria** (p. 861).
Petioles short and stout.
Leaves coriaceous, with thick revolute margins (*sometimes opposite*). **Jacquinia** (p. 804).
Leaves subcoriaceous, slightly revolute.
Leaves reticulate-veined beneath.
Leaves oval to obovate or oblong-oval, more or less pubescent while young. **Vaccinium** (p. 802).
Leaves oblong to oblong-obovate, glabrous. **Cyrilla** (p. 666).
Leaves obscurely veined beneath, glabrous.
Leaves oblong-lanceolate, narrowed toward the emarginate apex, decurrent nearly to base of petiole. **Cliftonia** (p. 667).
Leaves rounded at apex, distinctly petioled. **Maytenus** (p. 676).

**Leaves deciduous.

† Leaves conspicuous. (††, see p. xxvi.)

a Leaves entire, sometimes 3 or 4-lobed. (*aa*, see p. xxv).
b Stipules present.
Juice milky. **Maclura** (p. 331).
Juice watery.
Stipules connate, enveloping the young leaves, their scars encircling the branchlet.
Leaves acute or acuminate, entire; winter-buds pointed, nearly terete. **Magnolia** (p. 342).
Leaves truncate, sinuately 4-lobed; winter-buds obtuse, compressed. **Liriodendron** (p. 351).
Stipules distinct.
Branches spinescent; leaves glandular, caducous (*crenately serrate on vigorous shoots*). **Dalea** (p. 621).
Branches not spinescent; leaves without glands.
Winter-buds with a single pair of connate scales. **Salix** (p. 138).
Winter-buds with several pairs of imbricate scales.
Branchlets without a terminal bud; leaves 3-nerved. **Celtis** (p. 318).
Branchlets with a terminal bud, leaves penniveined. **Quercus sp.** 17–20 (p. 262).
bb Stipules wanting.
c Branchlets bright green and lustrous for the first 2 or 3 years; leaves sometimes 3-lobed, aromatic. **Sassafras** (p. 362).
cc Branchlets brown or gray.
d Leaves acute or acuminate.
Leaves 10′–12′ long, obovate-oblong, acuminate, glabrous, emitting a disagreeable odor. **Asimina** (p. 353).
Leaves smaller.
Petioles very slender, 1′–2′ long; leaves elliptic, acuminate. **Cornus alternifolia** (p. 789).
Petioles short.
Branchlets with a terminal bud.
Leaf-scars about as long as broad; branchlets without lenticels, light reddish brown. **Elliottia** (p. 791).
Leaf-scars crescent-shaped, broader than long, with 3 distinct bundle-traces.

Leaves pubescent on both sides, rugulose above; petioles 1′–2′ long, like the young branchlet densely pubescent. **Leitneria** (p. 167).

Leaves glabrous and smooth above, glabrous or pubescent below; petioles and branchlets usually glabrous or nearly so at maturity. **Nyssa** (p. 779).

Branchlets without a terminal bud.

Pubescence consisting of simple hairs or wanting.

Leaves 4′–6′ long, pubescent beneath while young; branchlet light brown or gray. **Diospyros virginiana** (p. 821).

Leaves 1½′–3′ long, glabrous; branches light yellowish gray. **Schœpfia** (p. 336)

Pubescence stellate; leaves obovate or elliptic, 2½′–5′ long, pubescent below. **Styrax** (p. 829).

dd Leaves obtuse or acute.

Branchlets not spinescent.

Leaves glabrous at maturity, their petioles slender. **Cotinus** (p. 657).

Leaves pubescent below at maturity; their petioles short and thick. **Diospyros texana** (p. 823).

Branchlets spinescent; leaves often fascicled on lateral branchlets. **Bumelia** (p. 812).

aa Leaves serrate or pinnately lobed.

b Stipules present. (*bb*, see p. xxvi.)

c Winter-buds naked.

Leaves oblique at base, the upper side rounded or subcordate, obovate, coarsely toothed. **Hamamelis** (p. 368).

Leaves equal at base, cuneate, finely serrate or crenate. **Rhamnus sp.** 2, 3 (p. 724, 725).

cc Winter-buds with a single pair of connate scales.

Primary veins arching and uniting within the margins; leaves simply serrate or crenate, sometimes entire. **Salix** (p. 138).

Primary veins extending to the teeth, leaves doubly serrate, often slightly lobed. **Alnus** (p. 220).

ccc Winter-buds with several pairs of imbricate scales.

d Terminal buds wanting; branchlets prolonged by an upper axillary bud.

Juice milky; leaves usually ovate, often lobed. **Morus** (p. 328).

Juice watery; leaves not lobed.

Leaves distinctly oblique at base.

Leaves with numerous prominent lateral veins.

Leaves generally broad-ovate, simply serrate, stellate-pubescent at least while young, rarely glabrous. **Tilia** (p. 732).

Leaves never broad-ovate, usually doubly serrate, more or less pubescent with simple hairs, at least while young.

Winter-buds ovoid, usually acute, ⅓ to nearly as long as petioles; leaves 1′–7′ long, doubly serrate. **Ulmus** (p. 309).

Winter-buds subglobose, minute; leaves 2′–2½′ long, crenate-serrate. **Planera** (p. 316).

Leaves 3 or 4-nerved from the base. **Celtis** (p. 318).

Leaves slightly or not at all oblique at base.

Leaves 3-nerved from the base, glandular-crenate or glandular-serrate. **Ceanothus** (p. 726).

Leaves not or obscurely 3-nerved at base, usually doubly serrate.

Leaves blue-green; petioles ¼′–½′ long; bark smooth, gray-brown. **Carpinus** (p. 201).

Leaves yellow-green.

Bark rough, furrowed; petioles ⅛′–¼′ long; leaves not resinous-glandular. **Ostrya** (p. 202).

Bark flaky or cherry-tree like; petioles ¼′–1′ long; leaves often resinous-glandular while young. **Betula** (p. 205).

dd Terminal buds present.

Primary veins arching and uniting within the margin (*extending to the margin in the lobed leaves of Malus*).

Winter-buds resinous; leaves crenate, usually truncate at base; petioles slender. **Populus** (p. 119).
Winter-buds not resinous.
Leaf-scars with 3 bundle-traces.
Leaves involute in bud, often lobed on vigorous shoots; winter-buds obtuse, short, pubescent. **Malus** (p. 379).
Leaves conduplicate (*or in some species of Prunus convolute*), never lobed; winter-buds acute.
Winter-buds elongated; branches never spinescent. **Amelanchier** (p. 393).
Winter-buds not elongated, ovoid; branches sometimes spinescent. **Prunus** (p. 555).
Leaf-scars with 1 bundle-trace; leaves simply serrate. **Ilex sp.** 5–6 (p. 673).
Primary veins extending to the teeth or to the lobes.
Leaves lobed. **Quercus sp.** 1–16, 35–50 (pp. 241, 283).
Leaves serrate-toothed.
Winter-buds with numerous scales.
Leaves lustrous beneath, remotely serrate or denticulate; winter-buds elongated, acuminate. **Fagus** (p. 228).
Leaves pale beneath, coarsely dentate or serrate; winter-buds acute. Chestnut Oaks. **Quercus sp.** 51–54 (p. 303).
Winter-buds with 2 pairs of scales. **Castanea** (p. 230).
Leaves doubly or simply serrate, or lobed, with serrate lobes; branches often furnished with spines.
Leaves involute in the bud; branchlets often ending in blunt spines. **Malus** (p. 379).
Leaves conduplicate in the bud; branches usually armed with sharp-pointed single or branched axillary spines. **Cratægus** (p. 397).

bb Stipules wanting.
c Leaves not lobed.
Leaves subcoriaceous, oblong, sometimes nearly entire, glabrous. **Symplocos** (p. 831).
Leaves thin.
Leaves oblong-obovate, acute, pubescent beneath. **Gordonia alatamaha** (p. 752).
Leaves oblong or lanceolate, acuminate, glabrous or puberulous while young, turning scarlet in the autumn. **Oxydendrum** (p. 796).
Leaves ovate to elliptic, stellate-pubescent or glabrous, turning yellow in the autumn. **Halesia** (p. 824).
cc Leaves palmately lobed.
Stipules large, foliaceous, united; branchlets without a terminal bud. **Platanus** (p. 371).
Stipules small, free, caducous; branchlets with a terminal bud. **Liquidambar** (p. 367).

†† Leaves inconspicuous or wanting; branches spiny or prickly.

Branches or stems succulent, armed with numerous prickles.
Branches and stems columnar, ribbed, continuous; leaves 0. **Cereus** (p. 757).
Branches jointed, tuberculate; leaves scale-like. **Opuntia** (p. 759).
Branches rigid, spinescent.
Leaves minute, narrow-obovate.
Branchlets bright green. **Kœberlinia** (p. 754).
Branchlets red-brown. **Dalea** (p. 621).
Leaves scale-like, caducous. **Canotia** (p. 677).

2. Leaves compound.

* Leaves 3-foliolate, without stipules.

Leaves persistent; leaflets obovate, entire, sessile. **Hypelate (p. 716).**
Leaves deciduous.

Leaflets deltoid to hastate, entire, rounded at apex; branches prickly.
Erythrina (p. 627).
Leaflets ovate to oblong, acuminate, strongly scented and bitter; branches unarmed.
Ptelea (p. 639).

** Leaves twice pinnate; stipules present.

a Leaves unequally twice pinnate, 2°–4° long, deciduous; leaflets serrate, 2′–3′ in length; branches and stem armed with scattered prickles. **Aralia** (p. 778).
aa Leaves equally twice pinnate, usually smaller; branches unarmed or armed with stipular or axillary spines (in *Parkinsonia* often apparently simply pinnate).
b Leaflets crenate; leaves simply or twice-pinnate on the same plant, deciduous, usually armed with simple or branched axillary spines. **Gleditsia** (p. 607).
bb Leaflets entire.
Leaflets 2–2½′ long; leaves deciduous; branchlets stout, unarmed.
Gymnocladus (p. 605).
Leaflets smaller; leaves usually persistent; branchlets slender.
Branches armed with prickles or spines.
Leaves with 2 or rarely 4 pinnæ.
Branches armed with axillary spines or spiny rachises.
Pinnæ with 4–8 leaflets; branches with short axillary spines.
Cercidium (p. 613).
Pinnæ with 8–60 leaflets; branches armed with spiny rachises or rigid branchlets terminating in stout spines. **Parkinsonia** (p. 611).
Branches armed with stipular prickles; leaves persistent.
Pinnæ with many oblong to linear leaflets. **Prosopis** (p. 599).
Pinnæ with 1 pair of orbicular to broad-oblong leaflets.
Pithecolobium unguis-cati (p. 586).
Leaves with 6, or more, rarely 4, pinnæ.
Prickles usually spreading, often recurved. **Acacia** (p. 591).
Prickles usually more or less ascending, straight. **Pithecolobium** (p. 586).
Branches unarmed.
Branchlets and petioles glabrous; leaves with 2–5 pair of pinnæ, each with 40–80 leaflets. **Lysiloma** (p. 589).
Branchlets and petioles pubescent while young; leaves with 5–17 pair of many-foliolate pinnæ, or pinnæ 2–4 and each with 8–16 leaflets.
Leucæna (p. 596).

*** Leaves simply pinnate.

a Leaves equally pinnate.
Stipules wanting.
Leaflets 2–4, generally oblong-obovate. **Exothea** (p. 714).
Leaflets 6–12.
Leaflets obtuse, usually oblong-obovate.
Leaflets 8–12, 2′–3′ long, pale below; leaves occasionally opposite.
Simarouba (p. 642).
Leaflets 6–8, 1′–1½′ long, green below. **Xanthoxylum coriaceum** (p. 637).
Leaflets 6–8, acuminate. **Swietenia** (p. 648).
Stipules present.
Branches armed with infra-stipular spines in pairs; leaflets 10–15, usually oblong-obovate, ½′–¾′ long, persistent. **Olneya** (p. 626).
Branches unarmed; leaflets 20–46, ovals ½′–⅔′ long. **Eysenhardtia** (p. 620).
aa Leaves unequally pinnate.
b Stipules present.
Leaflets sharply serrate; leaves deciduous; winter-buds resinous.
Sorbus (p. 390).
Leaflets entire or crenately serrate.
Leaves deciduous.
Leaflets 7–11, 3′–4½′ long; branches unarmed.
Leaflets usually alternate, thin and glabrous at maturity.
Cladrastis (p. 618).

Leaflets opposite, coriaceous, pubescent beneath at least along the veins. **Ichthyomethia** (p. 628).

Leaflets 9–21, 1–2 cm. long.
Branches usually with stipular prickles, sometimes viscid. **Robinia** (p. 622).
Branches unarmed, not viscid; leaflets 13–19, elliptic. **Sophora affinis** (p. 617).

Leaves persistent.
Leaflets 7–9, oblong-elliptic, 1′–2½′ long; branches unarmed. **Sophora secundiflora** (p. 616).
Leaflets 10–15; branches prickly. **Olneya** (p. 626).

bb Stipules wanting.
d Leaves persistent.
Leaflets long-stalked (*sometimes nearly sessile in Xanthoxylum flavum*).
Leaflets oblong-ovate, cuneate at base.
Leaflets acuminate, glabrous. **Picramnia** (p. 643).
Leaflets obtuse, tomentose when unfolding. **Xanthoxylum flavum** (p. 636).
Leaflets broad-ovate, usually rounded or subcordate at base. **Metopium** (p. 658).

Leaflets sessile or nearly so.
Petiole and rachis winged.
Leaflets crenate, obovate, about ½′ long; branches prickly. **Xanthoxylum Fagara** (p. 634).
Leaflets entire.
Leaflets oblong, usually acute, 3′–4′ long. **Sapindus saponaria** (p. 712).
Leaflets spathulate, rounded at apex, not more than ¾′ long. **Pistacia** (p. 656).
Petiole and rachis not winged.
Leaflets 7–19, acuminate, 2′–5′ long. **Sapindus marginatus** (p. 713).
Leaflets 21–41, obtuse, ½′–¾′ long. **Alvaradoa** (p. 644).

dd Leaves deciduous.
Leaflets long-stalked, 3–7, entire, acute. **Bursera** (p. 645).
Leaflets sessile or nearly so.
Branches prickly; leaflets crenate. **Xanthoxylum clava-Herculis** (p. 635).
Branches unarmed.
Juice milky or viscid; leaflets serrate or entire; rachis sometimes winged. **Rhus species 1–3** (p. 660).
Juice watery.
Rachis without wings.
Leaflets entire, acuminate, 7–9. **Sapindus Drummondii** (p. 714).
Leaflets serrate or crenate.
Winter-buds large; leaflets 5–23, aromatic.
Winter-buds naked. **Juglans** (p. 169).
Winter-buds covered with scales. **Carya** (p. 176).
Winter-buds minute, globose, scaly; leaflets 5–7, ovate, not aromatic. **Ungnadia** (p. 717).
Rachis winged; leaflets 10–20, entire, rounded at apex, not more than ½′ long. **Bursera microphylla** (p. 647).

TREES OF NORTH AMERICA

TREES OF NORTH AMERICA

(Exclusive of Mexico)

Class 1. GYMNOSPERMÆ.

Ovules and seeds borne on the face of a scale, not inclosed in an ovary; resinous trees, with stems increasing in diameter by the annual addition of a layer of wood inside the bark.

I. PINACEÆ.

Trees, with narrow or scale-like generally persistent clustered or alternate leaves and usually scaly buds. Flowers appearing in early spring, mostly surrounded at the base by an involucre of the more or less enlarged scales of the buds, unisexual, monœcious (*diœcious in Juniperus*), the male consisting of numerous 2-celled anthers, the female of scales bearing on their inner face 2 or several ovules, and becoming at maturity a woody cone or rarely a berry. Seeds with or without wings; seed-coat of 2 layers; embryo axile in copious albumen; cotyledons 2 or several. Of the twenty-nine genera scattered over the surface of the globe, but most abundant in northern temperate regions, thirteen occur in North America.

CONSPECTUS OF THE NORTH AMERICAN GENERA.

Scales of the female flowers numerous; spirally arranged in the axils of persistent bracts; ovules 2, inverted; seeds borne directly on the scales, attached at the base in shallow depressions on the inner side of the scales, falling from them at maturity and usually carrying away a scarious terminal wing; leaves fascicled or scattered (*deciduous in Larix*). Abietineæ.

Fruit maturing in two or rarely in three seasons; leaves fascicled, needle-shaped in axillary 1–5-leaved clusters, inclosed at the base in a membranaceous sheath; cone-scales thick and woody, much longer than their bracts. **1. Pinus**

Fruit maturing in one season.

Leaves in many-leaved clusters on short spur-like branchlets, deciduous; cone-scales thin, usually shorter than their bracts. **2. Larix.**

Leaves scattered, linear.

Cones pendulous, the scales persistent on the axis.

Branchlets roughened by the persistent leaf-bases; leaves deciduous in drying; bracts shorter than the cone-scales.

Leaves sessile, 4-sided, or flattened and stomatiferous above. **3. Picea.**

Leaves stalked, flattened and stomatiferous below, or angular. **4. Tsuga.**

Branchlets not roughened by leaf-bases; leaves stalked, flattened; not deciduous in drying; bracts of the cone 2-lobed, aristate, longer than the scales. **5. Pseudotsuga.**

Cones erect, their scales deciduous from the axis, longer or shorter than the bracts; leaves sessile, flat or 4-sided. **6. Abies.**

Scales of the female flowers without bracts; ovules and seeds borne on the face of minute scales adnate to the base of the flower-scales, enlarging and forming the scales of the cone. Seeds with a narrow marginal wing (*wingless in Juniperas*).

Scales of the female flowers numerous, spirally arranged, forming a woody cone; ovules erect, 2 or many under each scale; leaves linear, alternate, often of 2 forms (*deciduous in Taxodium*). TAXODIÆ.

Ovules and seeds numerous under each scale. **7. Sequoia.**

Ovules and seeds 2 under each scale; leaves mostly spreading in 2 ranks. **8. Taxodium.**

Scales of the female flower few, decussate, forming a small cone, or rarely a berry; ovules 2 or many under each scale; leaves decussate or in 3 ranks, often of 2 forms, usually scale-like, mostly adnate to the branch, the earliest free and subulate. CUPRESSINEÆ.

Fruit a cone; leaves scale-like.

Cones oblong, their scales oblong, imbricated or valvate; seeds 2 under each scale, maturing the first year.

Scales of the cone 6, the middle ones only fertile; seeds unequally 2-winged. **9. Libocedrus.**

Scales of the cone 8–12; seeds equally 2-winged. **10. Thuja.**

Cones subglobose, the scales peltate, maturing in one or two years; seeds few or many under each scale.

Fruit maturing in two seasons; seeds many under each scale; branchlets terete or 4-winged. **11. Cupressus.**

Fruit maturing in one season; seeds 2 under each scale; branchlets flattened. **12. Chamæcyparis.**

Fruit a berry formed by the coalition of the scales of the flower; ovules in pairs or solitary; flowers dicœcious; leaves decussate or in 3's, subulate or scale-like, often of 2 forms. **13. Juniperus.**

1. PINUS Duham. Pine.

Trees or rarely shrubs, with deeply furrowed and sometimes laminate or with thin and scaly bark, hard or often soft heartwood often conspicuously marked by dark bands of summer cells impregnated with resin, pale nearly white sapwood, and large branch-buds formed during summer and composed of minute buds in the axils of bud-scales, becoming the bracts of the spring shoot. Leaves needle-shaped, clustered, the clusters borne on deciduous spurs in the axils of scale-like primary leaves, inclosed in the bud by numerous scales lengthening and forming a more or less persistent sheath at the base of each cluster. Male flowers clustered at the base of leafy growing shoots of the year, each flower surrounded at the base by an involucre of 3–6 scalelike bracts, composed of numerous sessile anthers, imbricated in many ranks and surmounted by crest-like nearly orbicular connectives; the female subterminal or lateral, their scales in the axils of non-accrescent bracts. Fruit a woody cone maturing at the end of the second or rarely of the third season, composed of the hardened and woody scales of the flower more or less thickened on the exposed surface (the *apophysis*), with the ends of the growth of the previous year appearing as terminal or dorsal brown protuberances or scars (the *umbo*). Seeds usually obovoid, shorter or longer than their wings or rarely wingless; outer seed-coat crustaceous or thick, hard, and bony, the inner membranaceous; cotyledons 3–18, usually much shorter than the inferior radicle.

Pinus is widely distributed through the northern hemisphere from the Arctic Circle to the West Indies, the mountains of Central America, the Canary Islands, northern Africa, the Philippine Islands, and Sumatra. About sixty-six species are recognized. Of exotic species the so-called Scotch Pine, *Pinus sylvestris* L., of Europe and Asia, the Swiss Stone Pine, *Pinus cembra* L., and the Austrian Pine and other forms of *Pinus nigra* Arnold, from central and southern Europe, are often planted in the northeastern states, and *Pinus Pinaster* Ait., of the coast region of western France and the Mediterranean Basin is successfully cultivated in central and southern California. *Pinus* is the classical name of the Pine-tree.

The North American species can be conveniently grouped in two sections, Soft Pines and Pitch Pines.

SOFT PINES.

Wood soft, close-grained, light-colored, the sapwood thin and nearly white; sheaths of the leaf-clusters deciduous; leaves with one fibro-vascular bundle.

Leaves in 5-leaved clusters.

Cones long-stalked, elongated, cylindric bright green at maturity, becoming light yellow-brown, their scales thin, with terminal unarmed umbos; seeds shorter than their wings. WHITE PINES.

Leaves without conspicuous white lines on the back.

Leaves slender, flexible; cones 4′–8′ long. **1. P. Strobus** (A).

Leaves stout, more rigid; cones 5′–11′ long. **2. P. monticola** (B, G).

Leaves with conspicuous white lines on the back; cones 12′–18′ long. **3. P. Lambertiana** (G).

Cones short-stalked, green or purple at maturity, their scales thick.

Cones cylindric or subglobose, their scales with terminal umbos; leaves 2′ long or less. STONE PINES.

Cones 3′–10′ long, their scales opening at maturity; seeds with wings. **4. P. flexilis** (F, H).

Cones ½′–3′ long, their scales remaining closed at maturity; seeds wingless. **5. P. albicaulis** (B, F, G).

Cones ovoid-oblong, their scales with dorsal umbos armed with slender prickles; seeds shorter than their wings; leaves in crowded clusters, incurved, less than 2′ long. FOXTAIL PINES.

Cones armed with minute incurved prickles. **6. P. Balfouriana** (G).

Cones armed with long slender prickles. **7. P. aristata** (F, G).

Leaves in 1–4-leaved clusters; cones globose, green at maturity, becoming light brown, their scales few, concave, much thickened, only the middle scales seed-bearing; seeds large and edible, their wings rudimentary; leaves 2′ or less, often incurved. NUT PINES. **8. P. cembroides** (C, F, G, H).

1. Pinus Strobus L. White Pine.

Leaves soft bluish green, whitened on the ventral side by 3–5 bands of stomata, 3′–5′ long, mostly turning yellow and falling in September in their second season, or persistent until the following June. **Flowers**: male yellow; female bright pink, with purple scale margins. **Fruit** fully grown in July of the second season, 4′–8′ long, opening and discharging its seeds in September; **seeds** narrowed at the ends, ¼′ long, red-brown mottled with black, about one fourth as long as their wings.

A tree, while young with slender horizontal or slightly ascending branches in regular whorls usually of 5 branches; at maturity often 100°, occasionally 220° high, with a tall straight stem 3°–4° or rarely 6° in diameter, when crowded in the forest with short branches forming a narrow head, or rising above its forest companions with long lateral branches sweeping upward in graceful curves, the upper branches ascending and forming a broad open irregular head, and slender branchlets coated at first with rusty tomentum, soon glabrous, and orange-brown in their first winter. **Bark** on young stems and branches thin, smooth, green tinged with red, lustrous during the summer, becoming 1′–2′ thick on old trunks and deeply divided by shallow fissures into broad connected ridges covered with small closely appressed purplish scales. **Wood** light, not strong, straight-grained, easily worked, light brown often slightly tinged with red; largely manufactured into lumber, shingles, and laths, used in construction, for cabinet-making, the interior finish of buildings, woodenware, matches, and the masts of vessels.

Distribution. Newfoundland to Manitoba, southward through the northern states to Pennsylvania, northern and eastern (Belmont County) Ohio, central Indiana, valley of the Rocky River near Oregon, Ogle County, Illinois, and central and southeastern Iowa, and along the Appalachian Mountains to eastern Kentucky and Tennessee and northern

Georgia; forming nearly pure forests on sandy drift soils, or more often in small groves scattered in forests of deciduous-leaved trees on fertile well-drained soil, also on the banks of streams, or on river flats, or rarely in swamps.

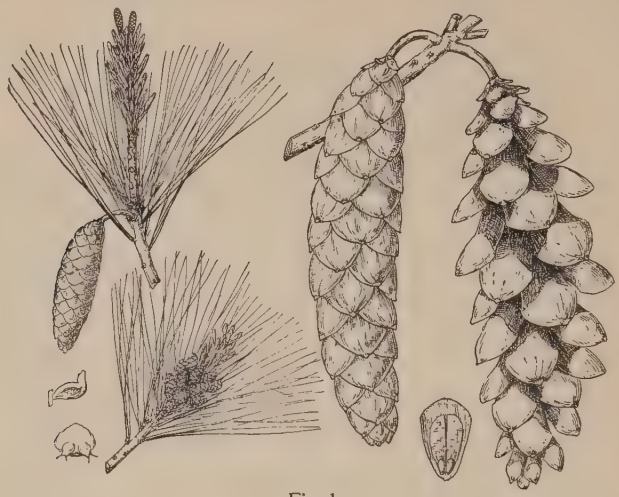

Fig. 1

Largely planted as an ornament of parks and gardens in the eastern states, and in many European countries, where it grows with vigor and rapidity; occasionally used in forest planting in the United States.

2. **Pinus monticola D. Don. White Pine.**

Leaves blue-green, glaucous, whitened by 2–6 rows of ventral and often by dorsal stomata, mostly persistent 3 or 4 years. **Flowers:** male yellow; female pale purple. **Fruit**

Fig. 2

5′–11′ long, shedding its seeds late in the summer or in early autumn; **seeds** narrowed at the ends, $\frac{1}{3}$′ long, pale red-brown mottled with black, about one third as long as their wings.

A tree, often 100° or occasionally 150° high, with a trunk frequently 4°–5° or rarely 7°–8° in diameter, slender spreading slightly pendulous branches clothing young stems to the ground and in old age forming a narrow open often unsymmetrical pyramidal head, and stout tough branchlets clothed at first with rusty pubescence, dark orange-brown and puberulous in their first and dark red-purple and glabrous in their second season. **Bark** of young stems and branches thin, smooth, light gray, becoming on old trees $\frac{3}{4}'$–$1\frac{1}{2}'$ thick and divided into small nearly square plates by deep longitudinal and cross fissures, and covered by small closely appressed purple scales. **Wood** light, soft, not strong, close, straight-grained, light brown or red; sometimes manufactured into lumber, used in construction and the interior finish of buildings.

Distribution. Scattered through mountain forests from the basin of the Columbia River in British Columbia to Vancouver Island; on the mountains of northern Washington to the western slopes of the Rocky Mountains of northern Montana; on the coast ranges of Washington and Oregon; and on the Cascade and Sierra Nevada ranges southward to the Kern River valley, California; most abundant and of its greatest value in northern Idaho on the bottom-lands of streams tributary to Lake Pend Oreille; reaching the sea-level on the southern shores of the Straits of Fuca and elevations of 10,000° on the California Sierras.

Often planted as an ornamental tree in Europe, and occasionally in the eastern United States where it grows more vigorously than any other Pine-tree of western America.

3. Pinus Lambertiana Dougl. Sugar Pine.

Leaves stout, rigid, $3\frac{1}{2}'$–$4'$ long, marked on the two faces by 2–6 rows of stomata; deciduous during their second and third years. **Flowers**: male light yellow; female pale green. **Fruit** fully grown in August and opening in October, $11'$–$18'$ or rarely $21'$ long; **seeds** $\frac{1}{2}'$–$\frac{5}{8}'$ long, dark chestnut-brown or nearly black, and half the length of their firm dark brown obtuse wings broadest below the middle and $\frac{1}{2}'$ wide.

A tree, in early life with remote regular whorls of slender branches often clothing the stem to the ground and forming an open narrow pyramid; at maturity 200°–220° high,

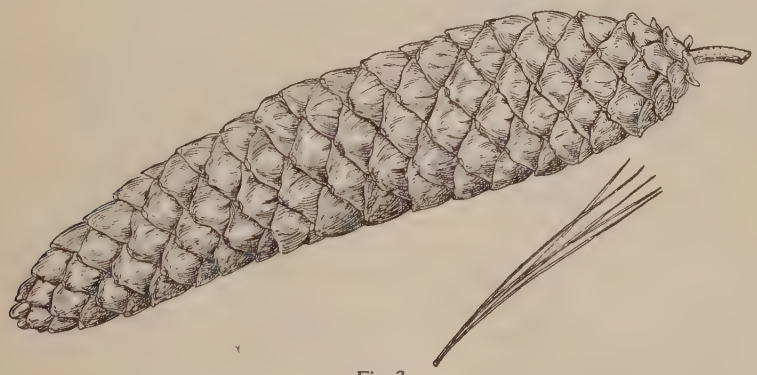

Fig. 3

with a trunk 6°–8° or occasionally 12° in diameter, a flat-topped crown frequently 60° or 70° across of comparatively slender branches sweeping outward and downward in graceful curves, and stout branchlets coated at first with pale or rufous pubescence, dark orange-brown during their first winter, becoming dark purple-brown. **Bark** on young stems and branches thin, smooth, dark green, becoming on old trunks $2'$–$3'$ thick and deeply and irregularly divided into long thick plate-like ridges covered with large loose rich purple-brown or cinnamon-red scales. **Wood** light, soft, straight-grained, light red-brown;

largely manufactured into lumber and used for the interior finish of buildings, woodwork, and shingles. A sweet sugar-like substance exudes from wounds made in the heartwood.

Distribution. Mountain slopes and the sides of ravines and cañons; western Oregon from the valley of the north branch of the Santiam River southward on the Cascade and coast ranges; California along the northern and coast ranges to Sonoma County; along the western slopes of the Sierra Nevada, where it grows to its greatest size at elevations between 3000° and 7000°; reappearing on the Santa Lucia Mountains of the coast ranges; and on the high mountains in the southwestern part of the state from Santa Barbara County southward usually at elevations of 5000°–7000° above the sea; and on the San Pedro Mártir Mountains in Lower California.

Occasionally planted as an ornamental tree in western Europe and in the eastern states, the Sugar Pine has grown slowly in cultivation and shows little promise of attaining the large size and great beauty which distinguish it in its native forests.

4. Pinus flexilis James. Rocky Mountain White Pine.

Pinus strobiformis Sarg., not Engelm.

Leaves stout, rigid, dark green, marked on all sides by 1–4 rows of stomata, $1\frac{1}{2}'$–$3'$ long, deciduous in their fifth and sixth years. **Flowers:** male reddish; female clustered, bright red-purple. **Fruit** subcylindric, horizontal or slightly declining, green or rarely purple at maturity, $3'$–$10'$ long, with narrow and more or less reflexed scales opening at maturity; **seeds** compressed, $\frac{1}{3}'$–$\frac{1}{2}'$ long, dark red-brown mottled with black, with a thick shell produced into a narrow margin, their wings about $\frac{1}{12}'$ wide, generally persistent on the scale after the seed falls.

Fig. 4

A tree, usually 40°–50°, occasionally 80° high, with a short trunk 2°–5° in diameter, stout long-persistent branches ultimately forming a low wide round-topped head, and stout branchlets orange-green and covered at first with soft fine pubescence, usually soon glabrous and darker colored; at high elevations often a low spreading shrub. **Bark** of young stems and branches thin, smooth, light gray or silvery white, becoming on old trunks $1'$–$2'$ thick, dark brown or nearly black, and divided by deep fissures into broad ridges broken into nearly square plates covered by small closely appressed scales. **Wood** light, soft, close-grained, pale clear yellow, turning red with exposure; occasionally manufactured into lumber.

Distribution. Eastern slope of the Rocky Mountains from Alberta to western Texas and westward on mountain ranges at elevations of 5000° to 12,000° to Montana, and southern California, reaching the western slopes of the Sierra Nevada at the head of King's River near the summit of San Gorgonio Mountain and in Snow Cañon, San Bernardino Range; usually scattered singly or in small groves; forming open forests on the eastern foothills of the Rocky Mountains of Montana and on the ranges of central Nevada; attaining its largest size on those of northern New Mexico and Arizona.

5. Pinus albicaulis Engelm. White Pine.

Leaves stout, rigid, slightly incurved, dark green, marked by 1–3 rows of dorsal stomata, clustered at the ends of the branches, $1\frac{1}{2}'$–$2\frac{1}{2}'$ long, persistent for from five to eight years. **Flowers** opening in July, scarlet. **Fruit** ripening in August, oval or subglobose, hori-

zontal, sessile, dark purple, 1½′–3′ long, with scales thickened, acute, often armed with stout pointed umbos, remaining closed at maturity; **seeds** wingless, acute, subcylindric or flattened on one side, ⅓′–½′ long, ⅓′ thick, with a thick dark chestnut-brown hard shell.

A tree, usually 20°–30° or rarely 60° high, generally with a short trunk 2°–4° in diameter, stout very flexible branches, finally often standing nearly erect and forming an open very irregular broad head, and stout dark red-brown or orange-colored branchlets puberulous for two years or sometimes glabrous; at high elevations often a low shrub, with wide-spreading nearly prostrate stems. **Bark** thin, except near the base of old trunks and broken by narrow fissures into thin narrow brown or creamy white plate-like scales. **Wood** light, soft, close-grained, brittle, light brown. The large sweet seeds are gathered and eaten by Indians.

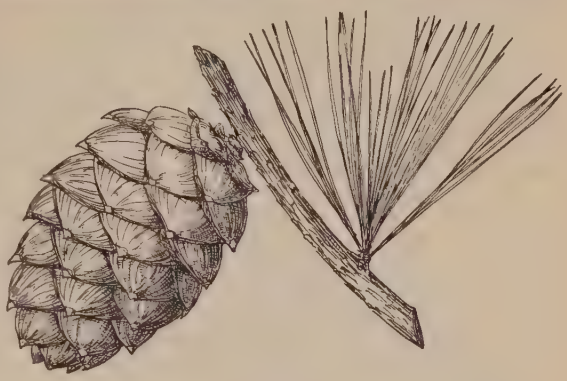

Fig. 5

Distribution. Alpine slopes and exposed ridges between 5000° and 12,000° elevation, forming the timber-line on many mountain ranges from latitude 53° north in the Rocky Mountains and British Columbia, southward to the Wind River and Salt River Ranges, Wyoming, the mountains of eastern Washington and Oregon, the Cascade Range, the mountains of northern California and the Sierra Nevada to Mt. Whitney.

6. Pinus Balfouriana Balf. Foxtail Pine.

Leaves stout, rigid, dark green and lustrous on the back, pale and marked on the ventral faces by numerous rows of stomata, 1′–1½′ long, persistent for ten or twelve years. **Flowers:** male dark orange-red; female dark purple. **Fruit** 3½′–5′ long, with scales armed with minute incurved prickles, dark purple, turning after opening dark red or mahogany color; **seeds** full and rounded at the apex, compressed at the base, pale, conspicuously mottled with dark purple, ½′ long, their wings narrowed and oblique at the apex, about 1′ long and ¼′ wide.

Fig. 6

A tree, usually 30°–40° or rarely 90° high, with a trunk generally 1°–2° or rarely 5° in diameter, short stout branches forming an open irregular pyramidal picturesque head, and long rigid more or less spreading puberulous, soon glabrous, dark orange-brown ultimately dark gray-brown or nearly black branchlets, clothed only at the extremities with the long dense brush-like masses of foliage. **Bark** thin, smooth, and milky white on the stems and branches of young trees, becoming on old trees sometimes ¾′ thick, dark red-brown, deeply divided into broad flat ridges,

broken into nearly square plates separating on the surface into small closely appressed scales. **Wood** light, soft and brittle, pale reddish brown.

Distribution. California, on rocky slopes and ridges, forming scattered groves on Scott Mountain, Siskiyou County, at elevations of 5000°–6000°; on the mountains at the head of the Sacramento River; on Mt. Yolo Bally in the northern Coast Range, and on the southern Sierra Nevada up to elevations of 11,500°, growing here to its largest size and forming an extensive open forest on the Whitney Plateau east of the cañon of Kern River, and at the highest elevations often a low shrub, with wide-spreading prostrate stems.

7. Pinus aristata Engelm. Foxtail Pine. Hickory Pine.

Leaves stout or slender, dark green, lustrous on the back, marked by numerous rows of stomata on the ventral faces, 1′-1½′ long, often deciduous at the end of ten or twelve years or persistent four or five years longer. **Flowers** male dark orange-red; female dark purple. **Fruit** 3′–3½′ long, with scales armed with slender incurved brittle prickles nearly ¼′ long, dark purple-brown on the exposed parts, the remainder dull red, opening and scattering their seeds about the 1st of October; **seeds** nearly oval, compressed, light brown mottled with black, ¼′ long, their wings broadest at the middle, about ⅓′ long and ¼′ wide.

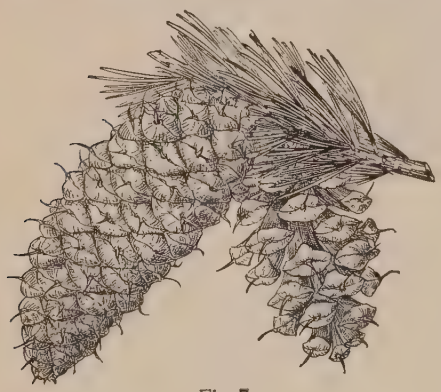

Fig. 7

A bushy tree, occasionally 40°–50° high, with a short trunk 2°–3° in diameter, short stout branches in regular whorls while young, in old age growing very irregularly, the upper erect and much longer than the usually pendulous lower branches, and stout light orange-colored, glabrous, or at first puberulous, ultimately dark gray-brown or nearly black branchlets clothed at the ends with long compact brush-like tufts of foliage. **Bark** thin, smooth, milky white on the stems and branches of young trees, becoming on old trees ½′–¾′ thick, red-brown, and irregularly divided into flat connected ridges separating on the surface into small closely appressed scales. **Wood** light, soft, not strong, light red; occasionally used for the timbers of mines and for fuel.

Distribution. Rocky or gravelly slopes at the upper limit of tree growth and rarely below 8,000° above the sea from the outer range of the Rocky Mountains of Colorado to those of southern Utah, central and southern Nevada, southeastern California, and the San Francisco peaks of northern Arizona.

8. Pinus cembroides Zucc. Nut Pine. Piñon.

Leaves in 2 or 3-leaved clusters, slender, much incurved, dark green, sometimes marked by rows of stomata on the 3 faces, 1′–2′ long, deciduous irregularly during their third and fourth years. **Flowers:** male in short crowded clusters, yellow; female dark red. **Fruit** subglobose, 1′–2′ broad; **seeds** subcylindric or obscurely triangular, more or less compressed at the pointed apex, full and rounded at base, nearly black on the lower side and dark chestnut-brown on the upper, ½′–¾′ long, the margin of their outer coat adnate to the cone-scale.

A bushy tree, with a short trunk rarely more than a foot in diameter and a broad round-topped head, usually 15°–20° high, stout spreading branches, and slender dark orange-colored branchlets covered at first with matted pale deciduous hairs, dark brown and sometimes nearly black at the end of five or six years; in sheltered cañons on the mountains of Arizona and in Lower California occasionally 50° or 60° tall. **Bark** about ½′ thick, irregu-

larly divided by remote shallow fissures and separated on the surface into numerous large thin light red-brown scales. **Wood** light, soft, close-grained, pale clear yellow. The large oily seeds are an important article of food in northern Mexico, and are sold in large quantities in Mexican towns.

Fig. 8

Distribution. Mountain ranges of central and southern Arizona, usually only above elevations of 6500°, often covering their upper slopes with open forests; in an isolated station on the Edwards Plateau on uplands and in cañons at the headwaters of the Frio and Nueces Rivers, Edwards and Kerr Counties, Texas; on the Sierra de Laguna, Lower California, and on many of the mountain ranges of northern Mexico; passing into the following varieties differing only in the number of the leaves in the leaf-clusters, and in their thickness.

Pinus cembroides var. Parryana Voss. Nut Pine. Piñon.

Pinus quadrifolia Sudw.

Leaves in 1–5 usually 4-leaved clusters, stout, incurved, pale glaucous green, marked on the three surfaces by numerous rows of stomata, $1\frac{1}{4}'$–$1\frac{1}{2}'$ long, irregularly deciduous, mostly falling in their third year.

A tree, 30°–40° high, with a short trunk occasionally 18′ in diameter, and thick spreading branches forming a compact regular pyramidal or in old age a low round-topped irregular head, and stout branchlets coated at first with soft pubescence, and light orange-brown. **Bark** $\frac{1}{2}'$–$\frac{3}{4}'$ thick, dark brown tinged with red, and divided by shallow fissures into broad flat connected ridges covered by thick closely appressed plate-like scales. **Wood** light, soft, close-grained, pale brown or yellow. The seeds form an important article of food for the Indians of Lower California.

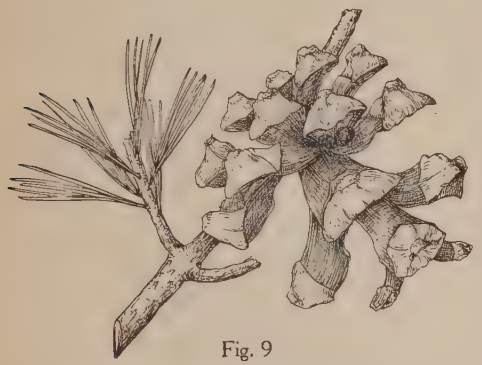

Fig. 9

Distribution. Arid mesas and low mountain slopes of Lower California southward to the foothills of the San Pedro Mártir Mountains, extending northward across the boundary of California to the desert slopes of the Santa Rosa Mountains, Riverside County, where it is common at elevations of 5000° above the sea-level.

Pinus cembroides var. edulis Voss. Nut Pine. Piñon.

Pinus edulis Engelm.

Leaves in 2 or rarely in 3-leaved clusters, stout, semiterete or triangular, rigid, incurved, dark-green, marked by numerous rows of stomata. $\frac{3}{4}'$–$1\frac{1}{2}'$ long, deciduous during the third or not until the fourth or fifth year, dropping irregularly and sometimes persistent for eight or nine years.

A tree often 40°–50° high with a tall trunk occasionally 2° in diameter and short erect

branches forming a narrow head, or frequently with a short divided trunk and a low round-topped head of spreading branches, and thick branchlets orange color during their first and second years, finally becoming light gray or dark brown sometimes tinged with red. **Bark** $\frac{1}{2}'$–$\frac{3}{4}'$ thick and irregularly divided into connected ridges covered by small closely appressed light brown scales tinged with red or orange color. **Wood** light, soft, not strong, brittle, pale brown; largely employed for fuel and fencing, and as charcoal used in smelting; in western Texas occasionally sawed into lumber. The seeds form an important article of food among Indians and Mexicans, and are sold in the markets of Colorado and New Mexico.

Fig. 10

Distribution. Eastern foothills of the outer ranges of the Rocky Mountains, from northern Colorado (Owl Cañon, Larimer County); to the extreme western part of Oklahoma (near Kenton, Cimmaron County, *G. W. Stevens*) and to western Texas, westward to eastern Utah, southwestern Wyoming, and to northern and central Arizona; over the mountains of northern Mexico, and on the San Pedro Mártir Mountains, Lower California; often forming extensive open forests at the eastern base of the Rocky Mountains, on the Colorado plateau, and on many mountain ranges of northern and central Arizona up to elevations of 7000° above the sea.

Pinus cembroides var. monophylla Voss. Nut Pine. Piñon.

Pinus monophylla Torr.

Leaves in 1 or 2-leaved clusters, rigid, incurved, pale glaucous green, marked by 18–20 rows of stomata, usually about $1\frac{1}{2}'$ long, sometimes deciduous during their fourth and fifth seasons, but frequently persistent until their twelfth year.

A tree usually 15°–20°, occasionally 40°–50° high, with a short trunk rarely more than a foot in diameter and often divided near the ground into several spreading stems, short thick branches forming while the tree is young a broad rather compact pyramid, and in old age often pendulous and forming a low round-topped often picturesque head, and stout light orange-colored ultimately dark brown branchlets. **Bark** about $\frac{3}{4}'$ thick and divided by deep irregular fissures into narrow connected flat ridges broken on the surface into thin closely appressed light or dark brown scales tinged with red or orange color. **Wood** light, soft, weak, and brittle; largely used for fuel, and charcoal used in smelting. The seeds supply an important article of food to the Indians of Nevada and California.

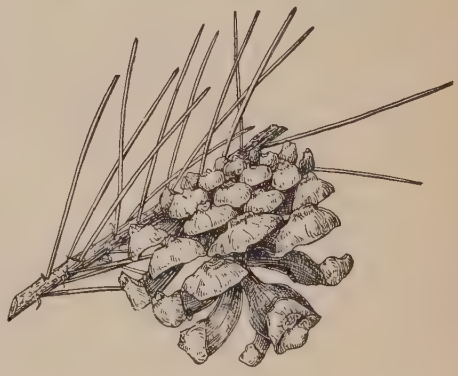

Fig. 11

Distribution. Dry gravelly slopes and mesas from the western base of the Wasatch Mountains of Utah, westward over the mountain ranges of Nevada to the eastern slopes of the southern Sierra Nevada, and to their western slope at the head-waters of the Tuolumne, Kings and Kern Rivers, and southward to northern Arizona and to the mountains

of southern California where it is common on the San Bernadino and San Jacinto Mountains between altitudes of 3500° and 7000°, and on the Sierra del Pinal, Lower California; often forming extensive open forests at elevations between 5000° and 7000°.

PITCH PINES.

Wood usually heavy, coarse-grained, generally dark-colored, with pale often thick sapwood; cones green at maturity (*sometimes purple in* 10 *and* 21) becoming various shades of brown; cone-scales more or less thickened, mostly armed; seeds shorter than their wings (*except in* 17 *and* 28); leaves with 2 fibro-vascular bundles.

Sheaths of the leaf-clusters deciduous; cones ½′–2′ long, maturing in the third year, leaves in 3-leaved clusters, slender, 2½′–4′ long. 9. **P. leiophylla** (H).

Sheaths of the leaf-clusters persistent.

Leaves in 3-leaved clusters (3 and 5-leaved in 10, 3–2 leaved in 12).

Cones subterminal, usually deciduous above the basal scales persistent on the branch.

Buds brown; leaves in 2–5-leaved clusters. 10. **P. ponderosa** (B,F,G,H).

Buds white. 11. **P. palustris** (C).

Cones lateral.

Cones symmetrical, their outer scales not excessively developed.

Leaves in 2 and 3-leaved clusters, 8′–12′ long; cones short-stalked. 12. **P. caribaea** (C).

Leaves in 3-leaved clusters; cones sessile.

Cones oblong-conic, prickles stout; leaves 6′–9′ long. 13. **P. taeda** (A, C).

Cones ovoid, prickles slender; leaves 3′–5′ long. 14. **P. rigida** (A, C).

Cones unsymmetrical by the excessive development of the scales on the outer side.

Cones 5′–6′ long, their scales not prolonged into stout, straight or curved spines.

Prickles of the cone-scales minute. 15. **P. radiata** (G).

Prickles of the cone-scales stout. 16. **P. attenuata** (G).

Cones 6′–14′ long, their scales prolonged into stout, straight or curved spines; leaves long and stout.

Cones oblong-ovoid; seeds longer than their wings. 17. **P. Sabiniana** (G).

Cones oblong-conic; seeds shorter than their wings. 18. **P. Coulteri** (G).

Leaves in 2-leaved clusters (2 and 3-leaved in 23).

Cones subterminal.

Cones symmetrical, 2′–2½′ long, their scales unarmed; leaves 5′–6′ long. 19. **P. resinosa** (A).

Cones unsymmetrical by the greater development of the scales on the outer side, armed with slender prickles; leaves 1′–4′ long. 20. **P. contorta** (B, F, G).

Cones lateral.

Cones about 2′ long.

Cone-scales very unevenly developed and mostly unarmed; cones incurved; leaves less than 2′ long. 21. **P. Banksiana** (A).

Cone-scales evenly developed, armed with weak or deciduous prickles; leaves up to 4′ in length.

Bark of the branches and upper trunk smooth. 22. **P. glabra** (C).

Bark of the branches and upper trunk roughened. 23. **P. echinata** (A, C).

Cones about 3′ long, armed with persistent spines.

Cone-scales armed with slender or stout prickles.

Cone-scales evenly developed, their prickles slender, acuminate, from a broad base; leaves 3′ long or less.

Cones opening at maturity. 24. **P. virginiana** (A, C).

Cones often remaining closed for many years. 25. **P. clausa** (C).

Cone-scales unevenly developed and armed with stout prickles; cones 2′–3½′ long, remaining closed; leaves 4′–6′ long. 26. **P. muricata.**

Cone-scales armed with very stout hooked spines; cones $2\frac{1}{2}'$–$3'$ long; opening in the autumn or remaining closed for two or three years; leaves $2'$ long or less. 27. **P. pungens.**

Leaves in 5-leaved clusters; cones $4'$–$6'$ long, unsymmetrical, their scales thick; seeds longer than their wings; leaves stout, $9'$–$13'$ long. 28. **P. Torreyana** (G).

9. Pinus leiophylla Schlecht. and Cham. Yellow Pine.

Pinus chihuahuana Engelm.

Leaves slender, pale glaucous green, marked by 6–8 rows of conspicuous stomata on each of the 3 sides, $2\frac{1}{2}'$–$4'$ long, irregularly deciduous from their fourth season, their sheaths deciduous. **Flowers:** male yellow; female yellow-green. **Fruit** ovoid, horizontal or slightly declining, long-stalked, $1\frac{1}{2}'$–$2'$ long, becoming light chestnut-brown and lustrous, maturing at the end of the third season, with scales only slightly thickened, their ultimately pale umbos armed with recurved deciduous prickles; **seeds** oval, rounded above and pointed below, about $\frac{1}{8}'$ long, with a thin dark brown shell, their wings $\frac{1}{3}'$ long and broadest near the middle.

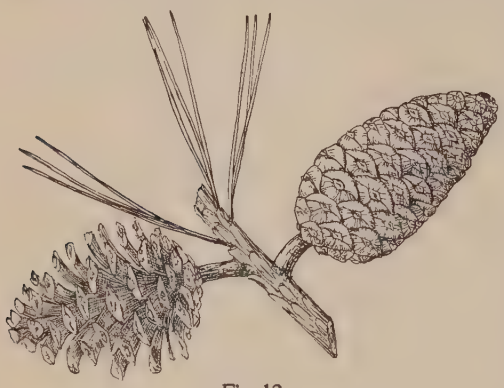

Fig. 12

A tree, rarely more than 40°–50° high, with a tall trunk sometimes 2° in diameter, stout slightly ascending branches forming a narrow open pyramidal or round-topped head of thin pale foliage, and slender bright orange-brown branchlets, soon becoming dull red-brown. **Bark** of old trunks $\frac{3}{4}'$–$1\frac{1}{2}'$ thick, dark reddish brown or sometimes nearly black, and deeply divided into broad flat ridges covered with thin closely appressed scales. **Wood** light, soft, not strong but durable, light orange color, with thick much lighter colored sapwood. Often forming coppice by the growth of shoots from the stump of cut trees.

Distribution. Mountain ranges of southern New Mexico and Arizona, usually at elevations between 6000° and 7000°; not common; more abundant on the Sierra Madre of northern Mexico and on several of the short ranges of Chihuahua and Sonora, and of a larger size in Mexico than in the United States.

10. Pinus ponderosa Laws. Yellow Pine. Bull Pine.

Leaves tufted at the ends of naked branches, in 2 or in 2 and 3-leaved clusters, stout, dark yellow-green, marked by numerous rows of stomata on the 3 faces, $5'$–$11'$ long, mostly deciduous during their third season. **Flowers:** male yellow; female clustered or in pairs, dark red. **Fruit** ellipsoidal, horizontal or slightly declining, nearly sessile or short-stalked, $3'$–$6'$ long, often clustered, bright green or purple when fully grown, becoming light reddish brown, with narrow scales much thickened at the apex and armed with slender prickles, mostly falling soon after opening and discharging their seeds, generally leaving the lower scales attached to the peduncle; **seeds** ovoid, acute, compressed at the apex, full and rounded below, $\frac{1}{4}'$ long, with a thin dark purple often mottled shell, their wings usually broadest below the middle, gradually narrowed at the oblique apex, $1'$–$1\frac{1}{4}'$ long, about $1'$ wide.

A tree, sometimes 150°–230° high, with a massive stem 5°–8° in diameter, short thick many-forked often pendulous branches generally turned upward at the ends and forming

a regular spire-like head, or in arid regions a broader often round-topped head surmounting a short trunk, and stout orange-colored branchlets frequently becoming nearly black at the end of two or three years. **Bark** for 80–100 years broken into rounded ridges covered with small closely appressed scales, dark brown, nearly black or light cinnamon-red, on older trees becoming 2′–4′ thick and deeply and irregularly divided into plates sometimes 4°–5° long and 12′–18′ wide, and separating into thick bright cinnamon-red scales. **Wood** hard, strong, comparatively fine-grained, light red, with nearly white sapwood sometimes composed of more than 200 layers of annual growth; largely manufactured into lumber used for all sorts of construction, for railway-ties, fencing, and fuel.

Fig. 13

Distribution. Mountain slopes, dry valleys, and high mesas from northwestern Nebraska and western Texas to the shores of the Pacific Ocean, and from southern British Columbia to Lower California and northern Mexico; extremely variable in different parts of the country in size, in the length and thickness of the leaves, size of the cones, and in the color of the bark. The form of the Rocky Mountains (var. *scopulorum*, Engelm.), ranging from Nebraska to Texas, and over the mountain ranges of Wyoming, eastern Montana and Colorado, and to northern New Mexico and Arizona, where it forms on the Colorado plateau with the species the most extensive Pine forests of the continent, has nearly black furrowed bark, rigid leaves in clusters of 2 or 3 and 3′–6′ long, and smaller cones, with thin scales armed with slender prickles hooked backward. More distinct is

Pinus ponderosa var. Jeffreyi Vasey.

This tree forms great forests about the sources of the Pitt River in northern California,

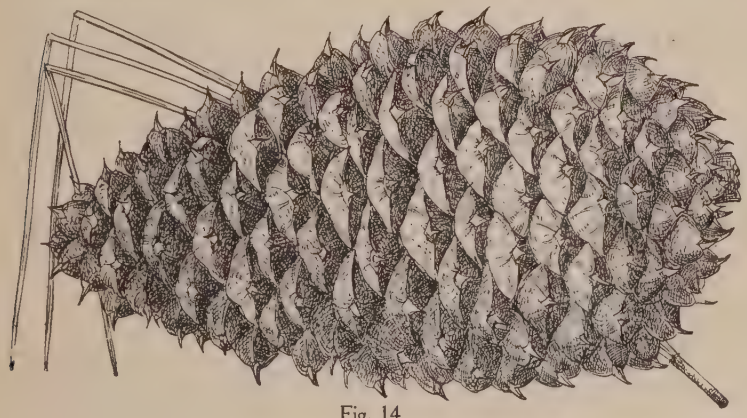

Fig. 14

along the eastern slopes of the central and southern Sierra Nevada, growing often on the most exposed and driest ridges, and in southern California on the San Bernardino and San Jacinto ranges up to elevations of 7000° above the sea, on the Cuyamaca Mountains, and in Lower California on the Sierra del Pinal and the San Pedro Mártir Mountains.

A tree, 100° to nearly 200° high, with a tall massive trunk 4°–6° in diameter, covered with bright cinnamon-red bark deeply divided into large irregular plates, stiffer and more elastic leaves 4′–9′ long and persistent on the glaucous stouter branchlets for six to nine years, yellow-green staminate flowers, short-stalked usually purple cones 5′–15′ long, their scales armed with stouter or slender prickles usually hooked backward, and seeds often nearly ½′ long with larger wings.

Occasionally planted as an ornamental tree in eastern Europe, especially the variety *Jeffreyi*, which is occasionally successfully cultivated in the eastern states.

Pinus ponderosa var. arizonica Shaw. Yellow Pine.

Pinus arizonica Engelm.

Leaves tufted at the ends of the branches, in 3–5-leaved clusters, stout, rigid, dark green, stomatiferous on their 3 faces, 5′–7′ long, deciduous during their third season. **Fruit** ovoid, horizontal, 2′–2½′ long, becoming light red-brown, with thin scales much thickened at the apex and armed with slender recurved spines; **seeds** full and rounded below, slightly compressed towards the apex, ⅛′ long, with a thick shell, their wings broadest above the middle, about ⅓′ long and ¼′ wide.

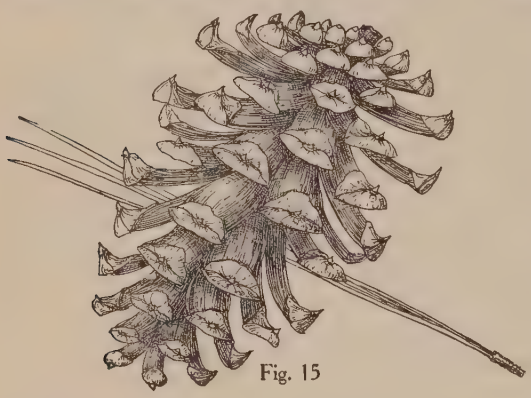

Fig. 15

A tree, 80°–100° high, with a tall straight massive trunk 3°–4° in diameter, thick spreading branches forming a regular open round-topped or narrow pyramidal head, and stout branchlets orange-brown and pruinose when they first appear, becoming dark gray-brown. **Bark** on young trunks dark brown or almost black and deeply furrowed, becoming on old trees 1½′–2′ thick and divided into large unequally shaped plates separating on the surface into thin closely appressed light cinnamon-red scales. **Wood** light, soft, not strong, rather brittle, light red or often yellow, with thick lighter yellow or white sapwood; in Arizona occasionally manufactured into coarse lumber.

Distribution. High cool slopes on the sides of cañons of the mountain ranges of southern Arizona at elevations between 6000° and 8000°, sometimes forming nearly pure forests; more abundant and of its largest size on the mountains of Sonora and Chihuahua.

11. Pinus palustris Mill. Long-leaved Pine. Southern Pine.

Leaves in crowded clusters, forming dense tufts at the ends of the branches, slender, flexible, pendulous, dark green, 8′–18′ long, deciduous at the end of their second year. **Flowers** in very early spring before the appearance of the new leaves, male in short dense clusters, dark rose-purple; female just below the apex of the lengthening shoot in pairs or in clusters of 3 or 4, dark purple. **Fruit** cylindric-ovoid, slightly curved, nearly sessile, horizontal or pendant, 6′–10′ long, with thin flat scales rounded at apex and armed with small

reflexed prickles, becoming dull brown; in falling leaving a few of the basal scales attached to the stem; **seeds** almost triangular, full and rounded on the sides, prominently ridged, about $\frac{1}{2}'$ long, with a thin pale shell marked with dark blotches on the upper side, and wings widest near the middle, gradually narrowed to a very oblique apex, about $1\frac{3}{4}'$ long and $\frac{7}{16}'$ wide.

A tree, 100°–120° high, with a tall straight slightly tapering trunk usually 2°–$2\frac{1}{2}$° or occasionally 3° in diameter, stout slightly branched gnarled and twisted limbs covered with thin dark scaly bark and forming an open elongated and usually very irregular head one third to one half the length of the tree, thick orange-brown branchlets, and acute winter-buds covered by elongated silvery white lustrous scales divided into long spreading filaments forming a cobweb-like network over the bud. **Bark** of the trunk $\frac{1}{6}'$–$\frac{1}{2}'$ thick, light orange-brown, separating on the surface into large closely appressed papery scales.

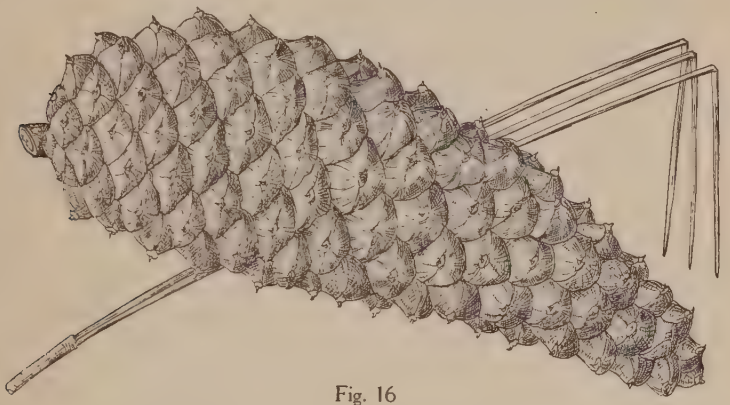

Fig. 16

Wood heavy, exceedingly hard, strong, tough, coarse-grained, durable, light red to orange color, with very thin nearly white sapwood; largely used as "southern pine" or "Georgia pine" for masts and spars, bridges, viaducts, railway-ties, fencing, flooring, the interior finish of buildings, the construction of railway-cars, and for fuel and charcoal. A large part of the naval stores of the world is produced from this tree, which is exceedingly rich in resinous secretions.

Distribution. Generally confined to a belt of late tertiary sands and gravels stretching along the coast of the Atlantic and Gulf states and rarely more than 125 miles wide, from southeastern Virginia to the shores of Indian River and the valley of the Caloosahatchee River, Florida, and along the Gulf coast to the uplands east of the Mississippi River, extending northward in Alabama to the southern foothills of the Appalachian Mountains and to central and western Mississippi (Hinds and Adams Counties) ranging inland in Georgia to the neighborhood of Cartersville and Rome, and ascending to altitudes of 1900 feet on the Blue Ridge in Alabama; and west of the Mississippi River to the valley of the Trinity River, Texas, and through eastern Texas and western Louisiana nearly to the northern borders of this state.

12. Pinus caribæa Morelet. Slash Pine. Swamp Pine.

Pinus Elliottii Engelm. *Pinus heterophylla* Sudw.

Leaves stout, in crowded 2 and 3-leaved clusters, dark green and lustrous, marked by numerous bands of stomata on each face, 8′–12′ long, deciduous at the end of their second season. **Flowers** in January and February before the appearance of the new leaves, male in short crowded clusters, dark purple; female lateral on long peduncles, pink. **Fruit** ovoid

or ovoid-conic, reflexed during its first year, pendant, 2′–6′ long, with thin flexible flat scales armed with minute incurved or recurved prickles, becoming dark rich lustrous brown; **seeds** almost triangular, full and rounded on the sides, $1\frac{1}{6}$′–$1\frac{1}{4}$′ long, with a thin brittle dark gray shell mottled with black, and dark brown wings $\frac{3}{4}$′–1′ long, $\frac{1}{4}$′ wide, their thickened bases encircling the seeds and often covering a large part of their lower surface.

A tree, often 100° high, with a tall tapering trunk $2\frac{1}{2}$°–3° in diameter, heavy horizontal branches forming a handsome round-topped head, and stout orange-colored ultimately dark branchlets. **Bark** $\frac{3}{4}$′–$1\frac{1}{2}$′ thick, and separating freely on the surface into large thin scales. **Wood** heavy, exceedingly hard, very strong, durable, coarse-grained, rich dark orange color, with thick nearly white sapwood; manufactured into lumber and used for construction and railway-ties. Naval stores are largely produced from this tree.

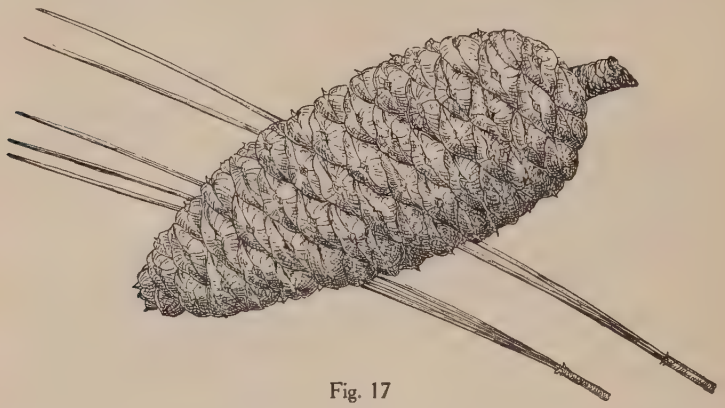

Fig. 17

Distribution. Coast region of South Carolina southward over the coast plain to the keys of southern Florida and along the Gulf coast to eastern Louisiana (Saint Tammany, Washington, southern Tangipahoa and eastern Livingston Parishes); common on the Bahamas, on the Isle of Pines, and on the lowlands of Honduras and eastern Guatemala: in the coast region of the southern states gradually replacing the Long-leaved Pine, *Pinus palustris*, Mill.

13. Pinus tæda L. Loblolly Pine. Old Field Pine.

Leaves slender, stiff, slightly twisted, pale green and somewhat glaucous, 6′–9′ long, marked by 10–12 rows of large stomata on each face, deciduous during their third year. **Flowers** opening from the middle of March to the first of May; male crowded in short spikes, yellow; female lateral below the apex of the growing shoot, solitary or clustered, short-stalked, yellow. **Fruit** oblong-conic to ovoid-cylindric, nearly sessile, 2′–6′ long, becoming light reddish brown, with thin scales rounded at the apex and armed with short stout straight or reflexed prickles, opening irregularly and discharging their seeds during the autumn and winter, and usually persistent on the branches for another year; **seeds** rhomboidal, full and rounded, $\frac{1}{4}$′ long, with a thin dark brown rough shell blotched with black, and produced into broad thin lateral margins, encircled to the base by the narrow border of their thin pale brown lustrous wing broadest above the middle, 1′ long, about $\frac{1}{4}$′ wide.

A tree, generally 80°–100° high, with a tall straight trunk usually about 2° but occasionally 5° in diameter, short thick much divided branches, the lower spreading, the upper ascending and forming a compact round-topped head, and comparatively slender glabrous branchlets brown tinged with yellow during their first season and gradually growing

darker in their second year. **Bark** of the trunk ¾′–1½′ thick, bright red-brown, and irregularly divided by shallow fissures into broad flat ridges covered with large thin closely appressed scales. **Wood** weak, brittle, coarse-grained, not durable, light brown, with orange-colored or often nearly white sapwood, often composing nearly half the trunk; largely manufactured into lumber, used for construction and the interior finish of buildings.

Fig. 18

Distribution. Cape May, New Jersey through southern Delaware and eastern Maryland and southward to near Palatka, Putnam County, in eastern Florida, and in western Florida to the neighborhood of San Antonio, Pasco County, westward to middle North Carolina and through South Carolina and Georgia and the eastern Gulf states to the Mississippi River, extending into southern Tennessee and northeastern Mississippi; in Georgia and Alabama sometimes ascending to altitudes of 1500 feet; west of the Mississippi River from southern Arkansas and the southwestern part of Oklahoma through western Louisiana to the shores of the Gulf of Mexico, and through eastern Texas to the valley of the Colorado River; on the Atlantic coast often springing up on lands exhausted by agriculture; west of the Mississippi River one of the most important timber-trees, frequently growing in nearly pure forests on rolling uplands.

14. Pinus rigida Mill. Pitch Pine.

Leaves stout, rigid, dark yellow-green, marked on the 3 faces by many rows of stomata, 3′–5′ long, standing stiffly and at right angles with the branch, deciduous during their second year. **Flowers:** male in short crowded spikes, yellow or rarely purple; female often clustered and raised on short stout stems, light green more or less tinged with rose color. **Fruit** ovoid, acute at apex, nearly sessile, often clustered, 1′–3½′ long, becoming light brown, with thin flat scales armed with recurved rigid prickles, often remaining on the branches for ten or twelve years; **seeds** nearly triangular, full and rounded on the sides, ¼′ long, with a thin dark brown mottled roughened shell and wings broadest below the middle, gradually narrowed to the very oblique apex, ¾′ long, ⅓′ wide.

Fig. 19

A tree, 50°–60° or rarely 100° high, with a short trunk occasion-

ally 3° in diameter, thick contorted often pendulous branches covered with thick much roughened bark, forming a round-topped thick head, often irregular and picturesque, and stout bright green branchlets becoming dull orange color during their first winter and dark gray-brown at the end of four or five years; often fruitful when only a few feet high. **Bark** of young stems thin and broken into plate-like dark red-brown scales, becoming on old trunks $\frac{3}{4}'$–$1\frac{1}{2}'$ thick, deeply and irregularly fissured, and divided into broad flat connected ridges separating on the surface into thick dark red-brown scales often tinged with purple. **Wood** light, soft, not strong, brittle, coarse-grained, very durable, light brown or red, with thick yellow or often white sap-wood; largely used for fuel and in the manufacture of charcoal; occasionally sawed into lumber.

Distribution. Sandy plains and dry gravelly uplands, or less frequently in cold deep swamps; island of Mt. Desert, Maine, to the northern shores of Lake Ontario, and southward to southern Delaware and southern Ohio (Scioto County) and along the Appalachian Mountains to northern Georgia and to their western foothills in West Virginia, Kentucky, and Tennessee; very abundant in the coast region south of Massachusetts; sometimes forming pure forests in New Jersey and Pennsylvania.

Pinus rigida var. serotina Loud. Pond Pine. Marsh Pine.

Pinus serotina Michx.

Leaves in clusters of 3 or occasionally of 4, slender, flexuose, dark yellow-green, 6′–8′ long, marked by numerous rows of stomata on the 3 faces, deciduous during their third and fourth years. **Flowers:** male in crowded spikes, dark orange color; female clustered or in pairs on stout stems. **Fruit** subglobose to ovoid, full and rounded or pointed at apex, subsessile or short-stalked, horizontal or slightly declining, 2–$2\frac{1}{2}'$ long, with thin nearly flat scales armed with slender incurved mostly deciduous prickles, becoming light yellow-brown at maturity, often remaining closed for one or two years and after opening long-persistent on the branches; **seeds** nearly triangular, often ridged below, full and rounded at the sides, $\frac{1}{3}'$ long, with a thin nearly black roughened shell produced into a wide border, the wings broadest at the middle, gradually narrowed at the ends, $\frac{3}{4}'$ long, $\frac{1}{4}'$ wide.

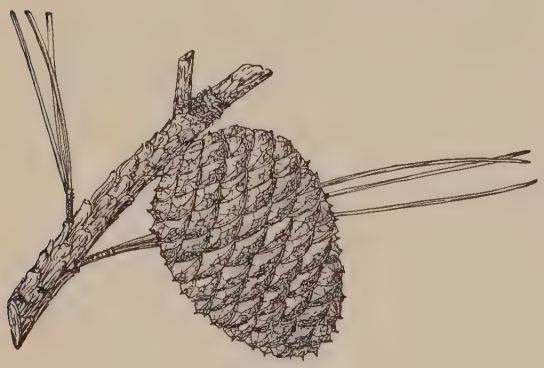

Fig. 20

A tree, usually 40°–50° or occasionally 70°–80′ high, with a short trunk sometimes 3° but generally not more than 2° in diameter, stout often contorted branches more or less pendulous at the extremities, forming an open round-topped head, and slender branchlets dark green when they first appear, becoming dark orange color during their first winter and dark brown or often nearly black at the end of four or five years. **Bark** of the trunk $\frac{1}{2}'$–$\frac{3}{4}'$ thick, dark red-brown and irregularly divided by narrow shallow fissures into small plates separating on the surface into thin closely appressed scales. **Wood** very resinous, heavy, soft, brittle, coarse-grained, dark orange color, with thick pale yellow sapwood; occasionally manufactured into lumber.

Distribution. Low wet flats or sandy or peaty swamps; near Cape May, New Jersey, and southeastern Virginia southward near the coast to northern Florida (near Kissimmee, Osceola County) and central Alabama.

15. Pinus radiata D. Don. Monterey Pine.

Leaves in 3, rarely in 2-leaved clusters, slender, bright rich green, 4′–6′ long, mostly deciduous during their third season. **Flowers:** male in dense spikes, yellow; female clustered, dark purple. **Fruit** ovoid, pointed at apex, very oblique at base, short-stalked, reflexed, 3′–7′ long, becoming deep chestnut-brown and lustrous, with scales much thickened and mammillate toward the base on the outer side of the cone, thinner on the inner side and at its apex, and armed with minute thickened incurved or straight prickles, long-persistent and often remaining closed on the branches for many years; **seeds** ellipsoidal, compressed, ¼′ long, with a thin brittle rough nearly black shell, their wings light brown, longitudinally striped, broadest above the middle, gradually narrowed and oblique at apex, 1′ long, ¼′ wide.

A tree, usually 40°–60° rarely 100°–115° high, with a tall trunk usually 1°–2° but occasionally 4½° in diameter, spreading branches forming a regular narrow open round-topped head, and slender branchlets light or dark orange color, at first often covered with a glaucous bloom, ultimately dark red-brown. **Bark** of the trunk 1½′–2′ thick, dark red-brown, and deeply divided into broad flat ridges broken on the surface into thick appressed plate-like scales. **Wood** light, soft, not strong, brittle, close-grained; occasionally used as fuel.

Fig. 21

Distribution. In a narrow belt a few miles wide on the California coast from Pescadero to the shores of San Simeon Bay; in San Luis Obispo County near the village of Cambria; on the islands of Santa Rosa and Santa Cruz of the Santa Barbara group; and on Guadaloupe Island off the coast of Lower California; most abundant and of its largest size on Point Pinos south of the Bay of Monterey, California.

Largely planted for the decoration of parks in western and southern Europe, occasionally planted in the southeastern states and in Mexico, Australia, New Zealand, and other regions with temperate climates, and more generally in the coast region of the Pacific states from Vancouver Island southward than any other Pine-tree.

16. Pinus attenuata Lemm. Knob-cone Pine.

Leaves slender, firm and rigid, pale yellow or bluish green, marked by numerous rows of stomata on their 3 faces, 3′–7′, usually 4′–5′ long. **Flowers:** male orange-brown; female fascicled, often with several fascicles on the shoot of the year. **Fruit** elongated, conic, pointed, very oblique at base by the greater development of the scales on the outer side, whorled, short-stalked, strongly reflexed and incurved, 3′–6′ long, becoming light yellow-brown, with thin flat scales rounded at apex, those on the outer side being enlarged into prominent transversely flattened knobs armed with thick flattened incurved spines, those on the inner side of the cone slightly thickened and armed with minute recurved prickles, persistent on the stems and branches for thirty or forty years, sometimes becoming completely imbedded in the bark of old trunks, and usually not opening until the death of the tree; **seeds** ellipsoidal, compressed, acute at apex, ¼′ long, with a thin oblique shell, their wings broadest at the middle, gradually narrowed to the ends, 1¼′ long, ⅓′ wide.

A tree, usually about 20° high, with a trunk a foot in diameter, and often fruitful when

only 4° or 5° tall; occasionally growing to the height of 80°–100°, with a trunk 2½° thick, and frequently divided above the middle into two ascending stems, slender branches arranged in regular whorls while the tree is young, and in old age forming a narrow round-topped straggling head of sparse thin foliage, and slender dark orange-brown branchlets growing darker during their second season. **Bark** of young stems and branches thin, smooth, pale brown, becoming at the base of old trunks ¼′–½′ thick and dark brown often tinged with purple, slightly and irregularly divided by shallow fissures and broken into large loose scales. **Wood** light, soft, not strong, brittle, coarse-grained, light brown, with thick sapwood sometimes slightly tinged with red.

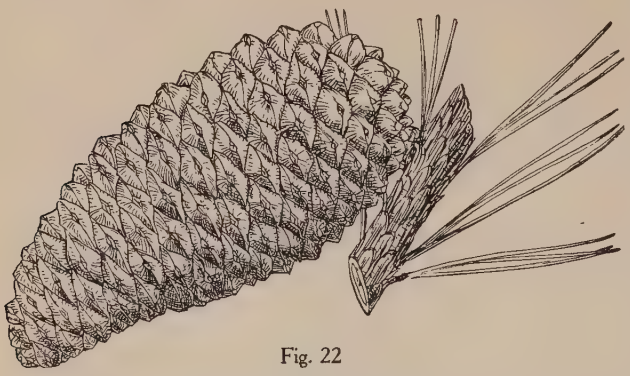

Fig. 22

Distribution. Dry mountain slopes from the valley of the Mackenzie River in Oregon over the mountains of southwestern Oregon, where it is most abundant and grows to its largest size, often forming pure forests over large areas, southward along the western slopes of the Cascade Mountains; in California on the northern cross ranges, the coast ranges from Trinity to Sonoma Counties, the western slopes of the Sierra Nevada to Mariposa County, and over the southern coast ranges from Santa Cruz to the dry arid southern slopes of the San Bernardino Mountains, where it forms a belt between City and East Twin Creeks at an altitude of 3500° above the sea.

17. Pinus Sabiniana Dougl. Digger Pine. Bull Pine.

Leaves stout, flexible, pendant, pale blue-green, marked on each face with numerous rows of pale stomata, 8′–12′ long, deciduous usually in their third and fourth years. **Flowers:** male yellow; female on stout peduncles, dark purple. **Fruit** oblong-ovoid, full and rounded at base, pointed, becoming light reddish brown, 6′–10′ long, long-stalked, pendulous, the scales narrowed into a stout incurved sharp hook, strongly reflexed toward the base of the cone and armed with spur-like incurved spines; **seeds** full and rounded below, somewhat compressed toward the apex, ¾′ long, ⅓′ wide, dark brown or nearly black, with a thick hard shell, encircled by their wings much

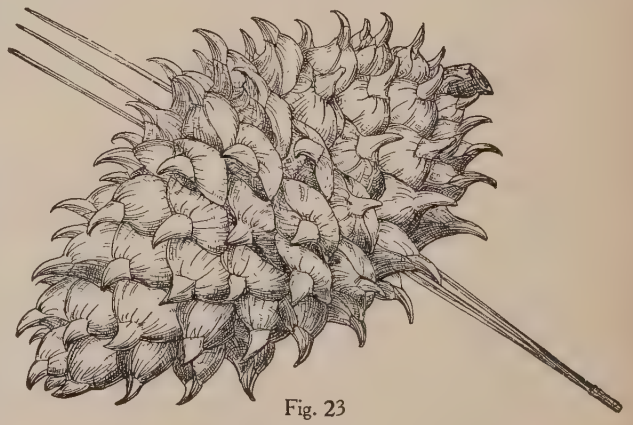

Fig. 23

thickened on the inner rim, obliquely rounded at the broad apex and about ½ length of nuts.

A tree, usually 40°–50° but occasionally 80° high, with a trunk 3°–4° in diameter, divided generally 15°–20° above the ground into 3 or 4 thick secondary stems, clothed with short crooked branches pendant below and ascending toward the summit of the tree, and forming an open round-topped head remarkable for the sparseness of its foliage, and stout pale glaucous branchlets, becoming dark brown or nearly black during their second season. **Bark** of the trunk 1½′–2′ thick, dark brown slightly tinged with red or nearly black and deeply and irregularly divided into thick connected ridges covered with small closely appressed scales. **Wood** light, soft, not strong, close-grained, brittle, light brown or red with thick nearly white sapwood. Abietine, a nearly colorless aromatic liquid with the odor of oil of oranges, is obtained by distilling the resinous juices. The large sweet slightly resinous seeds formed an important article of food for the Indians of California.

Distribution. Scattered singly or in small groups over the dry foothills of western California, ranging from 500° up to 4000° above the sea-level and from the southern slopes of the northern cross ranges to the Tehachapi Mountains and the Sierra de la Liebre; most abundant and attaining its largest size on the eastern foothills of the Sierra Nevada near the centre of the state at elevations of about 2000°; here often the most conspicuous feature of the vegetation.

18. Pinus Coulteri D. Don. Pitch Pine.

Leaves tufted at the ends of the branches, stout, rigid, dark blue-green, marked by numerous bands of stomata on the 3 faces, 6′–12′ long, deciduous during their third and

Fig. 24

fourth seasons. **Flowers:** male yellow; female dark reddish brown. **Fruit** oblong-conic, short-stalked and pendant, 10′–14′ long, becoming light yellow-brown, with thick broad scales terminating in a broad, flat, incurved, hooked claw ½′–1½′ long, gradually opening in the autumn and often persistent on the branches for several years; **seeds** cllipsoidal, compressed, ½′ long, ¼′–⅓′ wide, dark chestnut-brown, with a thick shell, inclosed by their wings, broadest above the middle, oblique at apex, nearly 1′ longer than the seed, about ⅝′ wide.

A tree, 40°–90° high, with a trunk 1°–2½° in diameter, thick branches covered with dark scaly bark, long and mostly pendulous below, short and ascending above, and forming a loose unsymmetrical often picturesque head, and very stout branchlets dark orange-brown at first, becoming sometimes nearly black at the end of three or four years. **Bark** of the

trunk $1\frac{1}{2}'$–$2'$ thick, dark brown or nearly black and deeply divided into broad rounded connected ridges covered with thin closely appressed scales. **Wood** light, soft, not strong, brittle, coarse-grained, light red, with thick nearly white sapwood; occasionally used for fuel. The seeds were formerly gathered in large quantities and eaten by the Indians of southern California.

Distribution. Scattered singly or in small groves through coniferous forests on the dry slopes and ridges of the coast ranges of California at elevations of 3000°–6000° above the sea, from Mount Diablo and the Santa Lucia Mountains to the San Bernardino and Cuyamaca Mountains; and on the Sierra del Pinal, Lower California; most abundant on the San Bernardino and San Jacinto ranges at elevations of about 5000°.

19. Pinus resinosa Ait. Red Pine. Norway Pine.

Leaves slender, soft and flexible, dark green and lustrous, 5′–6′ long, obscurely marked on the ventral faces by bands of minute stomata, deciduous during their fourth and fifth seasons. **Flowers:** male in dense spikes, dark purple; female terminal, short-stalked, scarlet. **Fruit** ovoid-conic, subsessile, $2'$–$2\frac{1}{4}'$ long, with thin slightly concave scales, unarmed, becoming light chestnut-brown and lustrous at maturity; shedding their seeds early in the autumn and mostly persistent on the branches until the following summer; seeds oval, compressed, $\frac{1}{8}'$ long, with a thin dark chestnut-brown more or less mottled shell and wings broadest below the middle, oblique at apex, $\frac{3}{4}'$ long, $\frac{1}{4}'$–$\frac{1}{3}'$ broad.

Fig. 25

A tree, usually 70°–80° or occasionally 120° high, with a tall straight trunk 2°–3° or rarely 5° in diameter, thick spreading more or less pendulous branches clothing the young stems to the ground and forming a broad irregular pyramid, and in old age an open round-topped picturesque head, and stout branchlets at first orange color, finally becoming light reddish brown. **Bark** of the trunk $\frac{3}{4}'$–$1\frac{1}{4}'$ thick and slightly divided by shallow fissures into broad flat ridges covered by thin loose light red-brown scales. **Wood** light, hard, very close-grained, pale red, with thin yellow often nearly white sapwood; largely used in the construction of bridges and buildings, for piles, masts, and spars. The bark is occasionally used for tanning leather.

Distribution. Light sandy loam or dry rocky ridges, usually forming groves rarely more than a few hundred acres in extent and scattered through forests of other Pines and deciduous-leaved trees; occasionally on sandy flats forming pure forests; Nova Scotia to Lake St. John, westward through Quebec and central Ontario to the valley of the Winnipeg River, and southward to eastern Massachusetts, the mountains of northern Pennsylvania, and to central and southwestern (Port Huron) Michigan, Wisconsin, and Minnesota, most abundant, and growing to its largest size in the northern parts of these states; rare and local in eastern Massachusetts and southward.

Often planted for the decoration of parks, and the most desirable as an ornamental tree of the Pitch Pines which flourish in the northern states.

20. Pinus contorta Loud. Scrub Pine.

Leaves dark green, slender, 1′–1½′ long, marked by 6–10 rows of stomata on each face, mostly persistent 4–6 years. **Flowers** orange-red: male in short crowded spikes; female clustered or in pairs on stout stalks. **Fruit** ovoid to subcylindric, usually very oblique at base, horizontal or declining, often clustered, ¾′–2′ long, with thin slightly concave scales armed with long slender more or less recurved often deciduous prickles, and toward the base of the cone especially on the upper side developed into thick mammillate knobs, becoming light yellow-brown and lustrous, sometimes opening and losing their seeds as soon as ripe, or remaining closed on the branches and preserving the vitality of their seeds for many years; **seeds** oblique at apex, acute below, about ⅛′ long, with a thin brittle dark red-brown shell mottled with black and wings widest above the base, gradually tapering toward the oblique apex, ½′ long.

A tree, sometimes fertile when only a few inches high, usually 15°–20° or occasionally 30° tall, with a short trunk rarely more than 18′ in diameter, comparatively thick branches forming a round-topped compact and symmetrical or an open picturesque head, and stout branchlets light orange color when they first appear, finally becoming dark red-brown or occasionally almost black. **Bark** of the trunk ¾′–1′ thick, deeply and irregularly divided by vertical and cross fissures into small oblong plates covered with closely appressed dark red-brown scales tinged with purple or orange color. **Wood** light, hard, strong although brittle, coarse-grained, light brown tinged with red, with thick nearly white sapwood; occasionally used for fuel.

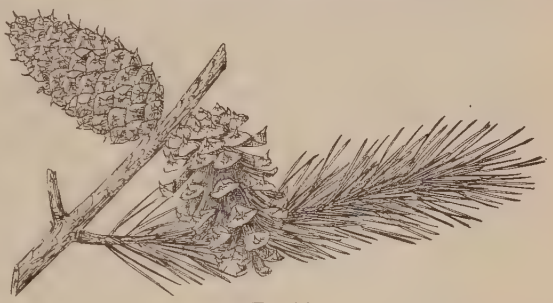

Fig. 26

Distribution. Coast of Alaska, usually in sphagnum-covered bogs southward in the immediate neighborhood of the coast to the valley of the Albion River, Mendocino County, California; south of the northern boundary of the United States generally inhabiting sand dunes and barrens or occasionally near the shores of Puget Sound the margins of tide pools and deep wet swamps; spreading inland and ascending the coast ranges and western slopes of the Cascade Mountains, where it is not common and where it gradually changes its habit and appearance, the thick deeply furrowed bark of the coast form being found only near the ground, while the bark higher on the stems is thin, light-colored, and inclined to separate into scales, and the leaves are often longer and broader. This is

Pinus contorta var. latifolia S. Wats. Lodge-pole Pine.

Pinus contorta var. *Murrayana* Engelm.

Leaves yellow-green, usually about 2′ long, although varying from 1′–3′ in length and from 1/16′ to nearly ⅛′ in width. **Fruit** occasionally opening as soon as ripe but usually remaining closed and preserving the vitality of the seeds sometimes for twenty years.

A tree, usually 70°–80° but often 150° high, with a trunk generally 2°–3° but occasionally 5°–6° in diameter, slender much-forked branches frequently persistent nearly to the base of the stem, light orange-colored during their early years, somewhat pendulous below, ascending near the top of the tree, and forming a narrow pyramidal spire-topped head.

Bark of the trunk rarely more than $\frac{1}{4}'$ thick, close and firm, light orange-brown and covered by small thin loosely appressed scales. **Wood** light, soft, not strong, close, straight-grained and easily worked, not durable, light yellow or nearly white, with thin lighter colored sapwood; occasionally manufactured into lumber; also used for railway-ties, mine-timbers, and for fuel.

Fig. 27

Distribution. Common on the Yukon hills in the valley of the Yukon River; on the interior plateau of northern British Columbia and eastward to the eastern foothills of the Rocky Mountains, covering with dense forests great areas in the basin of the Columbia River; forming forests on both slopes of the Rocky Mountains of Montana; on the Yellowstone plateau at elevations of 7000°–8000°; common on the mountains of Wyoming, and extending southward to southern Colorado; the most abundant coniferous tree of the northern Rocky Mountain region; common on the ranges of eastern Washington and Oregon, on the mountains of northern California, and southward along the Sierra Nevada, where it attains its greatest size and beauty in alpine forests at elevations between 8000° and 9500°; in southern California the principal tree at elevations between 7000° and 10,000° on the high peaks of the San Bernardino and San Jacinto Mountains; on the upper slopes of the San Pedro Mártir Mountains, Lower California.

21. Pinus Banksiana Lamb. Gray Pine. Jack Pine.

Pinus divaricata Du Mont de Cours.

Leaves in remote clusters, stout, flat or slightly concave on the inner face, at first light yellow-green, soon becoming dark green, $\frac{3}{4}'$–$1\frac{1}{4}'$ long, gradually and irregularly deciduous in their second or third year. **Flowers:** male in short crowded clusters, yellow; female

Fig. 28

clustered, dark purple, often with 2 clusters produced on the same shoot. **Fruit** oblong-conic, acute, oblique at base, sessile, usually erect and strongly incurved, $1\frac{1}{2}'$–$2'$ long, dull purple or green when fully grown, becoming light yellow and lustrous, with thin stiff

scales often irregularly developed, and armed with minute incurved often deciduous prickles; **seeds** nearly triangular, full and rounded on the sides, $\frac{1}{12}'$ long, with an almost black roughened shell and wings broadest at the middle, full and rounded at apex, $\frac{1}{3}'$ long, $\frac{1}{8}'$ wide.

A tree, frequently 70° high, with a straight trunk sometimes free of branches for 20°–30° and rarely exceeding 2° in diameter, long spreading branches forming an open symmetrical head, and slender tough flexible pale yellow-green branchlets turning dark purple during their first winter and darker the following year; often not more than 20°–30° tall, with a stem 10′–12′ in diameter; generally fruiting when only a few years old; sometimes shrubby with several low slender stems. **Bark** of the trunk thin, dark brown slightly tinged with red, very irregularly divided into narrow rounded connected ridges separating on the surface into small thick closely appressed scales. **Wood** light, soft, not strong, close-grained, clear pale brown or rarely orange color, with thick nearly white sapwood; used for fuel and occasionally for railway-ties and posts; occasionally manufactured into lumber.

Distribution. From Nova Scotia to the valley of the Athabasca River and down the Mackenzie to about latitude 65° north, ranging southward to the coast of Maine, northern New Hampshire and Vermont, the Island of Nantucket (Wauwinet, *J. W. Harshberger*), northern New York, the shores of Saginaw Bay, Michigan, the southern shores of Lake Michigan in Illinois, the valley of the Wisconsin River, Wisconsin, and central and southeastern Minnesota (with isolated groves in Root River valley, near Rushford, Fillmore County); abundant in central Michigan, covering tracts of barren lands; common and of large size in the region north of Lake Superior; most abundant and of its greatest size west of Lake Winnipeg and north of the Saskatchewan, here often spreading over great areas of sandy sterile soil.

22. Pinus glabra Walt. Spruce Pine. Cedar Pine.

Leaves soft, slender, dark green, $1\frac{1}{2}'$–$3'$ long, marked by numerous rows of stomata, deciduous at the end of their second and in the spring of their third year. **Flowers:** male in short crowded clusters, yellow; female raised on slender slightly ascending peduncles. **Fruit** single or in clusters of 2 or 3, reflexed on short stout stalks, subglobose to oblong-ovoid, $\frac{1}{2}'$–$2'$ long, becoming reddish brown and rather lustrous, with thin slightly concave scales armed with minute straight or incurved usually deciduous prickles; **seeds** nearly triangular, full and rounded on the sides, $\frac{1}{8}'$ long, with a thin dark gray shell mottled with black and wings broadest below the middle, $\frac{5}{8}'$ long, $\frac{1}{4}'$ wide.

Fig. 29

A tree, usually 80°–100° or occasionally 120° high, with a trunk 2°–$2\frac{1}{2}$° or rarely $3\frac{1}{2}$° in diameter, comparatively small horizontal branches, and slender flexible branchlets at first light red more or less tinged with purple, ultimately dark reddish brown. **Bark** of young trees and upper trunks smooth pale gray becoming on old stems $\frac{1}{2}'$–$\frac{3}{4}'$ thick, slightly and irregularly divided by shallow fissures into flat connected ridges. **Wood** light, soft, not strong, brittle, close-grained, light brown, with thick nearly white sapwood; occasionally used for fuel and rarely manufactured into lumber.

Distribution. Valley of the lower Santee River, South Carolina to middle and northwestern Florida; banks of the Alabama River, Dallas County, Alabama; east central Mississippi, and sandy banks of streams in southeastern Louisiana; usually growing singly or in small groves; attaining its largest size and often occupying areas of considerable extent in northwestern Florida.

23. Pinus echinata Mill. Yellow Pine. Short-leaved Pine.

Leaves in clusters of 2 and of 3, slender, flexible, dark blue-green, 3′–5′ long, beginning to fall at the end of their second season and dropping irregularly until their fifth year. **Flowers:** male in short crowded clusters, pale purple; female in clusters of 2 or 3 on stout ascending stems, pale rose color. **Fruit** ovoid to oblong-conic, subsessile and nearly horizontal or short-stalked and pendant, generally clustered, $1\frac{1}{2}'$–$2\frac{1}{2}'$ long, becoming dull brown, with thin scales nearly flat below and rounded at the apex, armed with short straight or somewhat recurved frequently deciduous prickles; **seeds** nearly triangular, full and rounded on the sides, about $\frac{3}{16}'$ long, with a thin pale brown hard shell conspicuously mottled with black, their wings broadest near the middle, $\frac{1}{2}'$ long, $\frac{1}{8}'$ wide.

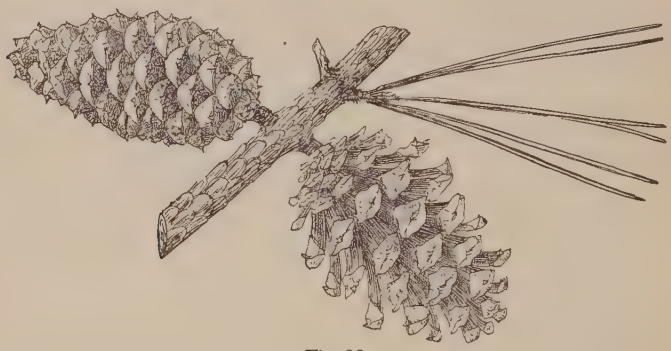

Fig. 30

A tree, usually 80°–100° occasionally 120° high, with a tall slightly tapering trunk 3°–4° in diameter, a short pyramidal truncate head of comparatively slender branches, and stout brittle pale green or violet-colored branchlets covered at first with a glaucous bloom, becoming dark red-brown tinged with purple before the end of the first season, their bark beginning in the third year to separate into large scales. **Bark** of the trunk $\frac{3}{4}'$–1′ thick and broken into large irregularly shaped plates covered with small closely appressed light cinnamon-red scales. **Wood** very variable in quality, and in the thickness of the nearly white sapwood, heavy, hard, strong and usually coarse-grained, orange-colored or yellow-brown; largely manufactured into lumber.

Distribution. Long Island (near Northport), and Staten Island, New York, and southern Pennsylvania to northern Florida, and westward through the Gulf states to eastern Texas, through Arkansas to southwestern Oklahoma (near Page, Leflore County, *G. W. Stevens*) and to southern Missouri and southwestern Illinois and to eastern Tennessee and western West Virginia; most abundant and of its largest size west of the Mississippi River.

24. Pinus virginiana Mill. Jersey Pine. Scrub Pine.

Leaves in remote clusters, stout, gray-green, $1\frac{1}{2}'$–3′ long, marked by many rows of minute stomata, gradually and irregularly deciduous during their third and fourth years. **Flowers:** male in crowded clusters, orange-brown; female on opposite spreading peduncles near the middle of the shoots of the year, generally a little below and alternate with 1 or 2

lateral branchlets, pale green, 2′–3′ long, the scale-tips tinged with rose color. **Fruit** ovoid-conic, often reflexed, dark red-brown and lustrous, with thin nearly flat scales, and stout or slender persistent prickles, opening in the autumn and slowly shedding their seeds, turning dark reddish brown and remaining on the branches for three or four years; **seeds** nearly oval, full and rounded, $\frac{1}{4}$′ long, with a thin pale brown rough shell, their wings broadest at the middle, $\frac{1}{3}$′ long, about $\frac{1}{8}$′ wide.

A tree, usually 30°–40° high, with a short trunk rarely more than 18′ in diameter, long horizontal or pendulous branches in remote whorls forming a broad open often flat-topped pyramid, and slender tough flexible branchlets at first pale green or green tinged with purple and covered with a glaucous bloom, becoming purple and later light gray-brown; toward the western limits of its range a tree frequently 100° tall, with a trunk $2\frac{1}{2}$°–3° in

Fig. 31

diameter. **Bark** of the trunk $\frac{1}{4}$′–$\frac{1}{2}$′ thick, broken by shallow fissures into flat plate-like scales separating on the surface into thin closely appressed dark brown scales tinged with red. **Wood** light, soft, not strong, brittle, coarse-grained, durable in contact with the soil, light orange color, with thick nearly white sapwood; often used for fuel and occasionally manufactured into lumber.

Distribution. Middle and southern New Jersey west of the pine barren region; Plymouth, Luzerne County, and central, southern and western Pennsylvania to Columbia County, Georgia, Dallas County, Alabama (near Selma, *T. G. Harbison*), and to the hills of northeastern Mississippi (Bear Creek near its junction with the Tennessee River, *E. N. Lowe*), through eastern and middle Tennessee to western Kentucky and to southeastern and southern (Scioto County) Ohio, and southern Indiana; usually small in the Atlantic states and only on light sandy soil, spreading rapidly over exhausted fields; of its largest size west of the Alleghany Mountains on the low hills of southern Indiana.

25. Pinus clausa Sarg. Sand Pine. Spruce Pine.

Leaves slender, flexible, dark green, 2′–$3\frac{1}{2}$′ long, marked by 10–20 rows of stomata, deciduous during their third and fourth years. **Flowers:** male in short crowded spikes, dark orange color; female lateral on stout peduncles. **Fruit** elongated ovoid-conic, often oblique at base, usually clustered and reflexed, 2′–$3\frac{1}{2}$′ long, nearly sessile or short-stalked, with convex scales armed with short stout straight or recurved prickles, becoming dark yellow-brown in autumn; some of the cones opening at once, others remaining closed for three or four years before liberating their seeds, ultimately turning to an ashy gray color; others still unopened becoming enveloped in the growing tissues of the stem and branches and finally entirely covered by them; **seeds** nearly triangular, compressed, $\frac{1}{4}$′ long, with a

black slightly roughened shell, their wings widest near or below the middle, $\frac{3}{4}'$ long, about $\frac{1}{4}'$ wide.

A tree, usually 15°–20° high, with a stem rarely a foot in diameter, generally clothed to the ground with wide-spreading branches forming a bushy flat-topped head, and slender tough flexible branchlets, pale yellow-green when they first appear, becoming light orange-brown and ultimately ashy gray; occasionally growing to the height of 70°–80° with a trunk 2° in diameter. **Bark** on the lower part of the trunk $\frac{1}{3}'$–$\frac{1}{2}'$ thick, deeply divided by narrow fissures into irregularly shaped generally oblong plates separating on the surface into thin closely appressed bright red-brown scales; on the upper part of the trunk and on the branches thin, smooth, ashy gray. **Wood** light, soft, not strong, brittle, light orange color or yellow, with thick nearly white sapwood; occasionally used for the masts of small vessels.

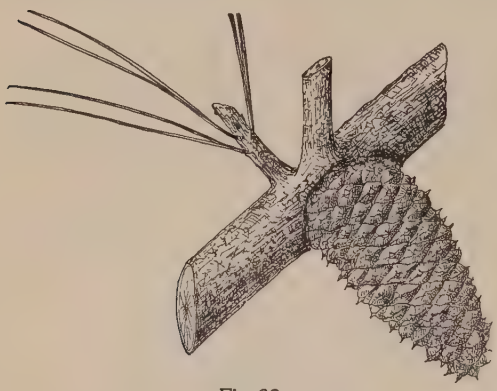

Fig. 32

Distribution. Coast of the Gulf of Mexico from southern Alabama to Peace River, western Florida; eastern Florida from the neighborhood of St. Augustine to New River, Dade County, covering sandy wind-swept plains near the coast; growing to its largest size and most abundant in the interior of the peninsula (Lake and Orange Counties).

26. Pinus muricata D. Don. Prickle-cone Pine.

Leaves in crowded clusters, thick, rigid, dark yellow-green, 4′–6′ long, beginning to fall in their second year. **Flowers:** male in elongated spikes, orange-colored; female short-

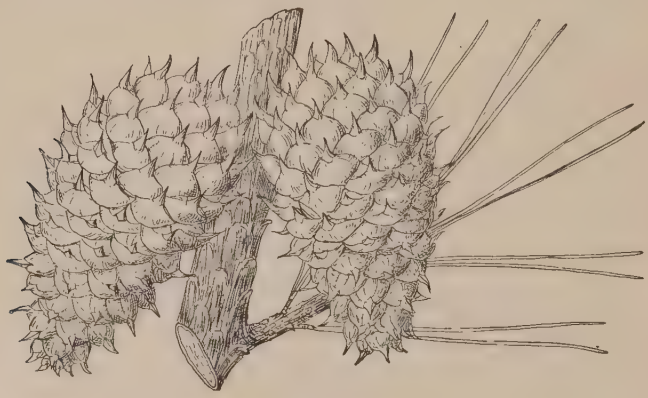

Fig. 33

stalked, whorled, 2 whorls often being produced on the shoot of the year. **Fruit** ovoid, oblique at base, sessile, in clusters of 3–5 or sometimes of 7, 2′–$3\frac{1}{2}'$ but usually about 3′ long, becoming light chestnut-brown and lustrous, with scales much thickened on the

outside of the cone, those toward its base produced into stout incurved knobs sometimes armed with stout flattened spur-like often incurved spines, and on the inside of the cone slightly flattened and armed with stout or slender straight prickles; often remaining closed for several years and usually persistent on the stem and branches during the entire life of the tree without becoming imbedded in the wood; **seeds** nearly triangular, $\frac{1}{4}'$ long, with a thin nearly black roughened shell, their wings broadest above the middle, oblique at apex, nearly 1′ long, $\frac{1}{8}'$ wide.

A tree, usually 40°–50° but occasionally 90° high, with a trunk 2°–3° in diameter, thick spreading branches covered with dark scaly bark, in youth forming a regular pyramid, and at maturity a handsome compact round-topped head of dense tufted foliage, and stout branchlets dark orange-green at first, turning orange-brown more or less tinged with purple. **Bark** of the lower part of the trunk often 4′–6′ thick and deeply divided into long narrow rounded ridges roughened by closely appressed dark purplish brown scales. **Wood** light, very strong, hard, rather coarse-grained, light brown, with thick nearly white sapwood; occasionally manufactured into lumber.

Distribution. California coast region from Mendocino County southward, usually in widely separated localities to Point Reyes Peninsula, north of the Bay of San Francisco, and from Monterey to Coon Creek, San Luis Obispo County; in Lower California on Cedros Island and on the west coast between Ensenada and San Quentin; of its largest size and the common Pine-tree on the coast of Mendocino County.

27. Pinus pungens Lamb. Table Mountain Pine. Hickory Pine.

Leaves in crowded clusters, rigid, usually twisted, dark blue-green, $1\frac{1}{4}'$–$2\frac{1}{2}'$ long, deciduous during their second and third years. **Flowers**: male in elongated loose spikes, yellow; female clustered, long-stalked. **Fruit** ovoid-conic, oblique at base by the greater development of the scales on the outer than on the inner side, sessile, reflexed, in clusters usually of 3 or 4, or rarely of 7 or 8, 2′–$3\frac{1}{2}'$ long, becoming light brown and lustrous, with thin tough scales armed with stout hooked curved spines produced from much thickened mammillate knobs, opening as soon as ripe and gradually shedding their seeds, or often remaining closed for two or three years longer, and frequently persistent on the branches for eighteen or twenty years; **seeds** almost triangular, full and rounded on the sides, nearly $\frac{1}{4}'$ long, with a thin conspicuously roughened light brown shell, their wings widest below the middle, gradually narrowed to the ends, 1′ long, $\frac{1}{4}'$ wide.

Fig. 34

A tree, when crowded in the forest occasionally 60° high, with a trunk 2°–3° in diameter, and a few short branches near the summit forming a narrow round-topped head; in open ground usually 20°–30° tall, and often fertile when only a few feet high, with a short thick trunk frequently clothed to the ground, and long horizontal branches, the lower pendulous toward the extremities, the upper sweeping in graceful upward curves and forming a flat-topped often irregular head, and stout branchlets, light orange color when they first appear,

soon growing darker and ultimately dark brown. **Bark** on the lower part of the trunk ¾′–1′ thick and broken into irregularly shaped plates separating on the surface into thin loose dark brown scales tinged with red, higher on the stem, and on the branches dark brown and broken into thin loose scales. **Wood** light, soft, not strong, brittle, very coarse-grained, pale brown, with thick nearly white sapwood; somewhat used for fuel, and in Pennsylvania manufactured into charcoal.

Distribution. Dry gravelly slopes and ridges of the Appalachian Mountains from southern Pennsylvania to North Carolina, eastern Tennessee and northern Georgia, sometimes ascending to elevations of 4000°, with isolated outlying stations in eastern Pennsylvania, western New Jersey, Maryland, the District of Columbia and Virginia; often forming toward the southern limits of its range pure forests of considerable extent.

28. Pinus Torreyana Carr. Torrey Pine.

Leaves forming great tufts at the ends of the branches, stout, dark green, conspicuously marked on the 3 faces by numerous rows of stomata, 8′–13′ long. **Flowers** from January to March; male yellow, in short dense heads; female subterminal on long stout peduncles.

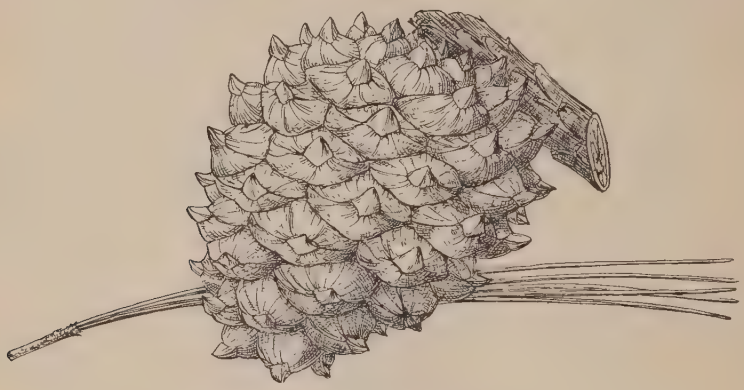

Fig. 35

Fruit broad-ovoid, spreading or reflexed on long stalks, 4′–6′ in length, becoming deep chestnut-brown, with thick scales armed with minute spines; mostly deciduous in their fourth year and in falling leaving a few of the barren scales on the stalk attached to the branch; **seeds** oval, more or less angled, ¾′–1′ long, dull brown and mottled on the lower side, light yellow-brown on the upper side, with a thick hard shell, nearly surrounded by their dark brown wings often nearly ½′ long.

A tree, usually 30°–40° high, with a short trunk about 1° in diameter, or occasionally 50°–60° tall, with a long straight slightly tapering stem 2½° in diameter, stout spreading and often ascending branches, and very stout branchlets bright green in their first season, becoming light purple and covered with a metallic bloom the following year, ultimately nearly black. **Bark** ¾′–1′ thick, deeply and irregularly divided into broad flat ridges covered by large thin closely appressed light red-brown scales. **Wood** light, soft, not strong, coarse-grained, light yellow, with thick yellow or nearly white sapwood; occasionally used for fuel. The large edible seeds are gathered in large quantities and are eaten raw or roasted.

Distribution. Only in a narrow belt a few miles long on the coast near the mouth of the Soledad River just north of San Diego and on the island of Santa Rosa, California; the least widely distributed Pine-tree of the United States.

Now planted in the parks of San Diego, California, and in New Zealand, growing rapidly in cultivation, and promising to attain a much larger size than on its native cliffs.

2. LARIX Adans. Larch.

Tall pyramidal trees, with thick sometimes furrowed scaly bark, heavy heartwood, thin pale sapwood, slender remote horizontal often pendulous branches, elongated leading branchlets, short thick spur-like lateral branchlets, and small subglobose buds, their inner scales accrescent and marking the lateral branchlets with prominent ring-like scars. Leaves awl-shaped, triangular and rounded above, or rarely 4-angled, spirally disposed and remote on leading shoots, on lateral branchlets in crowded fascicles, each leaf in the axil of a deciduous bud-scale, deciduous. Flowers solitary, terminal, the staminate globose, oval or oblong, sessile or stalked, on leafless branches, yellow, composed of numerous spirally arranged anthers with connectives produced above them into short points, the pistillate appearing with the leaves, short-oblong to oblong, composed of few or many green nearly orbicular stalked scales in the axes of much longer mucronate usually scarlet bracts. Fruit a woody ovoid-oblong conic or subglobose short-stalked cone composed of slightly thickened suborbicular or oblong-obovate concave scales, shorter or longer than their bracts, gradually decreasing from the centre to the ends of the cone, the small scales usually sterile. Seeds nearly triangular, rounded on the sides, shorter than their wings; the outer seed-coat crustaceous, light brown, the inner membranaceous, pale chestnut-brown and lustrous; cotyledons usually 6, much shorter than the inferior radicle.

Larix is widely distributed over the northern and mountainous region of the northern hemisphere from the Arctic Circle to the mountains of West Virginia and Oregon in the New World, and to central Europe, the Himalayas, Siberia, Korea western China, and Japan in the Old World. Ten species are recognized. Of the exotic species the European *Larix decidua*, Mill., has been much planted for timber and ornament in the northeastern states, where the Japanese *Larix Kœmpferi*, Sarg., also flourishes.

Larix is the classical name of the Larch-tree.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Cones small, subglobose; their scales few, longer than the bracts, leaves triangular. 1. **L. laricina** (A, B, F).

Cones elongated; their scales numerous, shorter than the bracts.

Young branchlets pubescent, soon becoming glabrous; leaves triangular. 2. **L. occidentalis** (B, G).

Young branchlets tomentose; leaves 4-angled. 3. **L. Lyallii** (B, F).

1. Larix laricina K. Koch. Tamarack. Larch.

Larix americana Michx.

Leaves linear, triangular, rounded above, prominently keeled on the lower surface, $\frac{3}{4}'$–$1\frac{1}{4}'$ long, bright green, conspicuously stomatiferous when they first appear; turning yellow and falling in September or October. **Flowers:** male subglobose and sessile; female oblong, with light-colored bracts produced into elongated green tips, and nearly orbicular rose-red scales. **Fruit** on stout incurved stems, subglobose, rather obtuse, $\frac{1}{2}'$–$\frac{3}{4}'$ long, composed of about 20 scales slightly erose on their nearly entire margins, rather longer than broad and twice as long as their bracts, bright chestnut-brown at maturity; usually falling during their second year; **seeds** $\frac{1}{8}'$ long, about one third as long as their light chestnut-brown wings broadest near the middle and obliquely rounded at apex.

A tree, 50°–60° high, with a trunk 18′–20′ in diameter, small horizontal branches forming during the early life of the tree a narrow regular pyramidal head always characteristic of this tree when crowded in the forest, or with abundant space sweeping out in graceful

curves, often becoming contorted and pendulous and forming a broad open frequently picturesque head, and slender leading branchlets often covered at first with a glaucous bloom, becoming light orange-brown during their first winter and conspicuous from the small globose dark red lustrous buds. **Bark** $\frac{1}{2}'$–$\frac{3}{4}'$ thick, separating into thin closely appressed rather bright reddish brown scales. **Wood** heavy, hard, very strong, rather coarse-grained, very durable, light brown; largely used for the upper knees of small vessels, fence-posts, telegraph-poles, and railway-ties.

Distribution. At the north often on well-drained uplands, southward in cold deep swamps which it often clothes with forests of closely crowded trees, from Labrador to the Arctic Circle, ranging west of the Rocky Mountains to latitude 65° 35′ north, and south-

Fig. 36

ward through Canada and the northern states to northern and eastern Pennsylvania, Garrett County, Maryland (Oakland to Thayerville), and Preston County, West Virginia (Cranesville Swamp), northern Indiana and Illinois, and northeastern Minnesota; along the eastern foothills of the Rocky Mountains to about latitude 53° and between the Yukon River and Cook Inlet, Alaska (*Larix alaskensis* Wight.); very abundant in the interior of Labrador, where it is the largest tree; common along the margins of the barren lands stretching beyond the sub-Arctic forest to the shores of the Arctic Sea; attaining its largest size north of Lake Winnipeg on low benches which it occasionally covers with open forests; on the eastern slopes of the northern Rocky Mountains usually at elevation from 600°–1700° above the sea; rare and local toward the southern limits of its range.

Occasionally planted as an ornamental tree in the northeastern states, growing rapidly and attaining in cultivation a large size and picturesque habit.

2. Larix occidentalis Nutt. Tamarack.

Leaves triangular, rounded on the back, conspicuously keeled below, rigid, sharp-pointed, 1′–$1\frac{3}{4}'$ long, about $\frac{1}{32}'$ wide, light pale green, turning pale yellow early in the autumn. **Flowers:** male short-oblong; female oblong, nearly sessile, with orbicular scales and bracts produced into elongated tips. **Fruit** oblong, short-stalked, 1′–$1\frac{1}{2}'$ long, with numerous thin stiff scales nearly entire and sometimes a little reflexed on their margins, much shorter than their bracts, more or less thickly coated on the lower surface below the middle with hoary tomentum, and standing after the escape of the seeds at right angles to the axis of the cone, or often becoming reflexed; **seeds** nearly $\frac{1}{4}'$ long, with a pale brown shell, one half to two thirds as long as the thin fragile pale wings broadest near the middle and obliquely rounded at apex.

A tree, sometimes 180° high, with a tall tapering naked trunk 6°–8° in diameter, or on dry soil and exposed mountain slopes usually not more than 100° tall, with a short narrow pyramidal head of small branches clothed with scanty foliage, or occasionally with a larger crown of elongated drooping branches, stout branchlets covered when they first appear with soft pale pubescence, usually soon glabrous, bright orange-brown in their first year, ultimately becoming dark gray-brown, and dark chestnut-brown winter-buds about $\frac{1}{8}'$ in diameter. **Bark** of young stems thin, dark-colored and scaly, becoming near the base of old trunks 5′ or 6′ thick and broken into irregularly shaped oblong plates often 2° long and covered with thin closely appressed light cinnamon-red scales. **Wood** very heavy, exceedingly hard and strong, close-grained, very durable in contact with the soil, bright

Fig. 37

light red, with thin nearly white sapwood; largely used for railway-ties and fence-posts, and manufactured into lumber used in cabinet-making and the interior finish of buildings.

Distribution. Moist bottom-lands and on high benches and dry mountain sides generally at elevations between 2000° and 7000° above sea-level, usually singly or in small groves, through the basin of the upper Columbia River from southern British Columbia to the western slopes of the continental divide of northern Montana, and to the eastern slopes of the Cascade Mountains of Washington and northern Oregon; most abundant and of its largest size on the bottom-lands of streams flowing into Flat Head Lake in northern Montana, and in northern Idaho.

Occasionally planted in the eastern states and in Europe, but in cultivation showing little promise of attaining a large size or becoming a valuable ornamental or timber-tree.

3. Larix Lyallii Parl. Tamarack.

Leaves 4-angled, rigid, short-pointed, pale blue-green, 1′–$1\frac{1}{2}'$ long. **Flowers**: male short-oblong; female ovoid-oblong, with dark red or occasionally pale yellow-green scales and dark purple bracts abruptly contracted into elongated slender tips. **Fruit** ovoid, rather acute, $1\frac{1}{2}'$–2′ long, subsessile or raised on a slender stalk coated with hoary tomentum, with dark reddish purple or rarely green erose scales, fringed and covered on their lower surface with matted hairs at maturity spreading nearly at right angles and finally much reflexed, much shorter than their dark purple very conspicuous long-tipped bracts; **seeds** full and rounded on the sides, $\frac{1}{8}'$ long and about half as long as their light red lustrous wings broadest near the base with nearly parallel sides.

A tree, usually 25°–50° high, with a trunk generally 18′–20′ but rarely 3°–4° in diameter, and remote elongated exceedingly tough persistent branches sometimes pendulous, developing very irregularly and often abruptly ascending at the extremities, stout branchlets

coated with hoary tomentum usually persistent until after their second winter, ultimately becoming nearly black, and prominent winter-buds with conspicuous long white matted hairs fringing the margins of their scales and often almost entirely covering the bud. **Bark** of young trees and of the branches thin, rather lustrous, smooth, and pale gray tinged with yellow, becoming loose and scaly on larger stems and on the large branches of

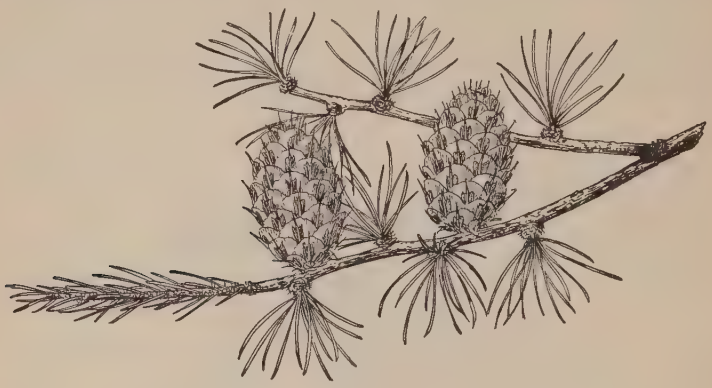

Fig. 38

old trees, and on fully grown trunks $\frac{1}{2}'$–$\frac{3}{4}'$ thick and slightly divided by shallow fissures into irregularly shaped plates covered by thin dark-red brown loosely attached scales. **Wood** heavy, hard, coarse-grained, light reddish brown.

Distribution. Near the timber-line on mountain slopes at elevations of 4000°–8000°, from southern Alberta on the eastern slope of the Rocky Mountains and from the interior of southern British Columbia, southward along the eastern slopes of the Cascade Mountains of northern Washington to Mt. Stewart at the head of the north fork of the Yakima River, and along the continental divide to the middle fork of Sun River, Montana, forming here a forest of considerable size at elevations of 7000°–8000°, and on the Bitter Root Mountains to the headwaters of the south fork of the Clearwater River, Idaho.

3. PICEA Dietr. Spruce.

Pyramidal trees, with tall tapering trunks often stoutly buttressed at the base, thin scaly bark, soft pale wood containing numerous resin-canals, slender whorled twice or thrice ramified branches, their ultimate divisions stout, glabrous or pubescent, and leaf-buds usually in 3's, the 2 lateral in the axils of upper leaves. Leaves linear, spirally disposed, extending out from the branch on all sides or occasionally appearing 2-ranked by the twisting of those on its lower side, mostly pointing to the end of the branch, entire, articulate on prominent persistent rhomboid ultimately woody bases, keeled above and below, 4-sided and stomatiferous on the 4 sides, or flattened and stomatiferous on the upper and occasionally on the lower side, persistent from seven to ten years, deciduous in drying. Flowers terminal or in the axils of upper leaves, the male usually long-stalked, composed of numerous spirally arranged anthers with connectives produced into broad nearly circular toothed crests, the female oblong, oval or cylindric, with rounded or pointed scales, each in the axis of an accrescent bract shorter than the scale at maturity. Fruit an ovoid or oblong, cylindric pendant cone, crowded on the upper branches or in some species scattered over the upper half of the tree. Seeds ovoid or oblong, usually acute at base, much shorter than their wings; outer seed-coat crustaceous, light or dark brown, the inner membranaceous, pale chestnut-brown; cotyledons 4–15.

Picea is widely distributed through the colder and temperate regions of the northern hemisphere, some species forming great forests on plains and high mountain slopes. Thirty-seven species are now recognized, ranging from the Arctic Circle to the slopes of the southern Appalachian Mountains and to those of northern New Mexico and Arizona in the New World, and to central and southeastern Europe, the Caucasus, the Himalayas, western China, Formosa and Japan. Of exotic species the so-called Norway Spruce, *Picea Abies* Karst., one of the most valuable timber-trees of Europe, has been largely planted for ornament and shelter in the eastern states, where the Caucasian *Picea orientalis* Carr., and some of the Japanese species also flourish.

Picea was probably the classical name of the Spruce-tree.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Leaves 4-sided, with stomata on the 4 sides.
- Cone-scales rounded at apex.
  - Cone-scales stiff and rigid at maturity; branchlets pubescent.
    - Cones ovoid on strongly incurved stalks, persistent for many years, their scales erose or dentate; leaves blue-green. **1. P. mariana** (A, B, F).
    - Cones ovoid-oblong, early deciduous, their scales entire or denticulate; leaves dark yellow-green. **2. P. rubra** (A).
  - Cone-scales soft and flexible at maturity; branchlets glabrous; cones oblong-cylindric, slender, their scales entire; leaves blue-green. 3. **P. glauca** (A, B, F).
- Cone-scales truncate or acute at apex, oblong or rhombic; leaves blue-green.
  - Cones oblong-cylindric or ellipsoidal; branchlets pubescent; leaves soft and flexible. **4. P. Engelmannii** (F, B, G).
  - Cones oblong-cylindric; branchlets glabrous; leaves rigid, spinescent. **5. P. pungens** (F).

Leaves flattened, usually with stomata only on the upper surface; cone-scales rounded.
- Cone-scales ovate, entire; branchlets pubescent; cones ellipsoidal, leaves obtuse. **6. P. Breweriana** (G).
- Cone-scales elliptic, denticulate above the middle; branchlets glabrous; cones oblong-cylindric, leaves acute or acuminate, with stomata occasionally on the lower surface. **7. P. sitchensis** (B, G).

1. Picea mariana B. S. P. Black Spruce.

Leaves slightly incurved above the middle, abruptly contracted at apex into short callous tips, pale blue-green and glaucous at maturity, $\frac{1}{4}'$–$\frac{3}{4}'$ long, hoary on the upper surface from the broad bands of stomata, and lustrous and slightly stomatiferous on the lower surface. **Flowers:** male subglobose, with dark red anthers; female oblong-cylindric, with obovate purple scales rounded above, and oblong purple glaucous bracts rounded and denticulate at apex. **Fruit** ovoid, pointed, gradually narrowed at the base into short strongly incurved stalks, $\frac{1}{2}'$–$1\frac{1}{2}'$ long, with rigid puberulous scales rounded or rarely somewhat pointed at apex and more or less erose on the notched pale margins, turning as they ripen dull gray-brown and becoming as the scales gradually open and slowly discharge their seeds almost globose; sometimes remaining on the branches for twenty or thirty years, the oldest close to the base of the branches near the trunk; **seeds** oblong, narrowed to the acute base, about $\frac{1}{8}'$ long, very dark brown, with delicate pale brown wings broadest above the middle, very oblique at the apex, about $\frac{1}{2}'$ long, $\frac{1}{8}'$ wide.

A tree, usually 20°–30° and occasionally 100° high, with a trunk 6′–12′ and rarely 3° in diameter, and comparatively short branches generally pendulous with upward curves, forming an open irregular crown, light green branchlets coated with pale pubescence, soon beginning to grow darker, and during their first winter light cinnamon-brown and covered with short rusty pubescence, their thin brown bark gradually becoming glabrous and beginning to break into small thin scales during their second year; at the extreme north

sometimes cone-bearing when only 2°–3° high. **Winter-buds** ovoid, acute, light reddish brown, puberulous, about $\frac{1}{8}'$ long. **Bark** $\frac{1}{4}'$–$\frac{1}{2}'$ thick and broken on the surface into thin rather closely appressed gray-brown scales. **Wood** light, soft, not strong, pale yellow-white, with thin sapwood; probably rarely used outside of Manitoba and Saskatchewan, except in the manufacture of paper pulp. Spruce-gum, the resinous exudations of the Spruce-trees of northeastern America, is gathered in considerable quantities principally in northern New England and Canada, and is used as a masticatory. Spruce-beer is made by boiling the branches of the Black and Red Spruces

Fig. 39

Distribution. At the north on well-drained bottom-lands and the slopes of barren stony hills, and southward in sphagnum-covered bogs, swamps, and on their borders, from Labrador to the valley of the Mackenzie River in about latitude 65° north, and, crossing the Rocky Mountains, through the interior of Alaska to the valley of White River; southward through Newfoundland, the maritime provinces, eastern Canada and the northeastern United States to central Pennsylvania, and along the Alleghany Mountains to northern Virginia; and from the eastern foothills of the Rocky Mountains in Alberta, through northern Saskatchewan and northern Manitoba, and south to northeastern and northern Minnesota, and central Wisconsin and Michigan; very abundant at the far north and the largest coniferous tree of Saskatchewan and northern Manitoba, covering here large areas and growing to its largest size; common in Newfoundland and all the provinces of eastern Canada except southern Ontario; in the United States less abundant, of small size, and usually only in cold sphagnum swamps (var. *brevifolia* Rehd.)

Occasionally planted as an ornamental tree, the Black Spruce is short-lived in cultivation and one of the least desirable of all Spruce-trees for the decoration of parks and gardens.

2. Picea rubra Link. Red Spruce.

Picea rubens Sarg.

Leaves more or less incurved above the middle, acute or rounded and furnished at the apex with short callous points, dark green often slightly tinged with yellow, very lustrous, marked on the upper surface by 4 rows and on the lower less conspicuously by 2 rows of stomata on each side of the prominent midrib, $\frac{1}{2}'$–$\frac{5}{8}'$ long, nearly $\frac{1}{16}'$ wide. **Flowers:** male oval, almost sessile, bright red; female oblong-cylindric, with thin rounded scales reflexed and slightly erose on their margins, and obovate bracts rounded and laciniate above. **Fruit** on very short straight or incurved stalks, ovoid-oblong, gradually narrowed from near the middle to the acute apex, $1\frac{1}{4}'$–$2'$ long, with rigid puberulous scales entire or slightly toothed at the apex; bright green or green somewhat tinged with purple when

fully grown, becoming light reddish brown and lustrous at maturity, beginning to fall as soon as the scales open in the autumn or early winter, and generally disappearing from the branches the following summer; seeds dark brown, about $\frac{1}{8}'$ long, with short broad wings full and rounded above the middle.

A tree, usually 70°–80° and occasionally 100° high, with a trunk 2°–3° in diameter, branches long-persistent on the stem and clothing it to the ground, forming a narrow rather conical head, or soon disappearing below from trees crowded in the forest, stout pubescent light green branchlets, becoming bright reddish brown or orange-brown during their first winter, glabrous the following year, and covered in their third or fourth year with scaly bark. **Winter-buds** ovoid, acute, $\frac{1}{4}'$–$\frac{1}{3}'$ long, with light reddish brown scales. **Bark** $\frac{1}{4}'$–$\frac{1}{2}'$ thick, and broken into thin closely appressed irregularly shaped red-brown scales. **Wood** light, soft, close-grained, not strong, pale slightly tinged with red, with paler sapwood usually about 2′ thick; largely manufactured into lumber in the northeastern states, Pennsylvania, and Virginia, and used for the flooring and construction of houses, for the sounding-boards of musical instruments, and in the manufacture of paper-pulp.

Fig. 40

Distribution. Well-drained uplands and mountain slopes, often forming a large part of extensive forests, from Prince Edward Island and the valley of the St. Lawrence southward to the coast of Massachusetts, along the interior hilly part of New England, New York, and northern Pennsylvania and on the slopes of the Alleghany Mountains at elevations above 2500 feet from West Virginia to North Carolina and Tennessee.

Occasionally planted in the eastern states and in Europe as an ornamental tree, but growing in cultivation more slowly than any other Spruce-tree.

3. Picea glauca Voss. White Spruce.

Picea canadensis B. S. P.

Leaves crowded on the upper side of the branches by the twisting of those on the lower side, incurved, acute or acuminate with rigid callous tips, pale blue and hoary when they first appear, becoming dark blue-green or pale blue, marked on each of the 4 sides by 3 or 4 rows of stomata, $\frac{1}{3}'$–$\frac{3}{4}'$ long. **Flowers:** male pale red, soon appearing yellow from the thick covering of pollen; female oblong-cylindric, with round nearly entire pale red or yellow-green scales, broader than long, and nearly orbicular denticulate bracts. **Fruit** nearly sessile or borne on short thin straight stems, oblong-cylindric, slender, slightly narrowed to the ends, rather obtuse at apex, usually about 2′ long, pale green sometimes tinged with red when fully grown, becoming at maturity pale brown and lustrous, with nearly orbicular scales, rounded, truncate, and slightly emarginate, or rarely narrowed at apex, and very thin, flexible and elastic at maturity, usually deciduous in the autumn or during the following winter; seeds about $\frac{1}{8}'$ long, pale brown, with narrow wings gradually widened from the base to above the middle and very oblique at the apex.

A tree, with disagreeable smelling foliage, rarely more than 60°–70° tall, with a trunk

not more than 2° in diameter, long comparatively thick branches densely clothed with stout rigid laterals sweeping out in graceful upward curves, and forming a broad-based rather open pyramid often obtuse at the apex, stout glabrous branchlets orange-brown during their first autumn and winter, gradually growing darker grayish brown. **Winter-buds** broadly ovoid, obtuse, covered by light chestnut-brown scales with thin often reflexed ciliate margins. **Bark** $\frac{1}{4}'$–$\frac{1}{2}'$ thick, separating irregularly into thin plate-like light gray scales more or less tinged with brown. **Wood** light, soft, not strong, straight-grained, light yellow, with hardly distinguishable sapwood; manufactured into lumber in the eastern provinces of Canada and in Alaska, and used in construction, for the interior finish of buildings, and for paper-pulp.

Fig. 41

Distribution. Banks and borders of streams and lakes, ocean cliffs, and in the north the rocky slopes of low hills, from Labrador along the northern frontier of the forest nearly to the shores of the Arctic Sea, reaching Behring Strait in 66° 44′ north latitude, and southward down the Atlantic coast to southern Maine, northern New Hampshire, Vermont, and New York, shores of Saginaw Bay, Michigan, northern Wisconsin and Minnesota, and through the interior of Alaska.

The variety (var. *albertiana* Sarg.) of the Gaspé Peninsula and the valleys of the Black Hills of South Dakota and of the Rocky Mountains of northern Wyoming, Montana, Alberta and northward, is a tree with a narrow pyramidal head, sometimes 150° high, with a trunk 3° to 4° in diameter, and shorter and rather broader cones than those of the typical White Spruce of the east, although not shorter or as short as the cones of that tree in the extreme north.

Often planted in Canada, northern New England, and northern Europe as an ornamental tree; in southern New England and southward suffering from heat and dryness.

4. Picea Engelmannii Engelm. White Spruce. Engelmann Spruce.

Leaves soft and flexible, with acute callous tips, slender, nearly straight or slightly incurved on vigorous sterile branches, stouter, shorter, and more incurved on fertile branches, 1′–$1\frac{1}{8}'$ long, marked on each face by 3–5 rows of stomata, covered at first with a glaucous bloom, soon becoming dark blue-green or pale steel-blue. **Flowers:** male dark purple; female bright scarlet, with pointed or rounded and more or less divided scales, and oblong bracts rounded or acute or acuminate and denticulate at apex or obovate-oblong and abruptly acuminate. **Fruit** oblong-cylindric to ellipsoidal, gradually narrowed to the ends, usually about 2′ long, sessile or very short-stalked, produced in great numbers on the upper branches, horizontal and ultimately pendulous, light green somewhat tinged with scarlet when fully grown, becoming light chestnut-brown and lustrous, with thin flexible slightly concave scales, generally erose-dentate or rarely almost entire on the margins, usually broadest at the middle, wedge-shaped below, and gradually contracted above into a truncate or acute apex, or occasionally obovate and rounded above; mostly deciduous in the autumn or early in their first winter soon after the escape of the seeds; **seeds** obtuse

at the base, nearly black, about $\frac{1}{8}'$ long and much shorter than their broad very oblique wings.

A tree, with disagreeable smelling foliage sometimes 120° high, with a trunk 3° in diameter, spreading branches produced in regular whorls and forming a narrow compact pyramidal head, gracefully hanging short lateral branches, and comparatively slender branchlets pubescent for three or four years, light or dark orange-brown or gray tinged with brown during their first winter, their bark beginning to separate into small flaky scales in their fourth or fifth year; at its highest altitudes low and stunted with elongated branches pressed close to the ground. **Winter-buds** conic or slightly obtuse, with pale chestnut-brown scales scarious and often free and slightly reflexed on the margins. **Bark** $\frac{1}{4}'$–$\frac{1}{2}'$ thick, light cinnamon-red, and broken into large thin loose scales. **Wood** light, soft, not strong, close-grained, pale yellow tinged with red, with thick hardly distinguishable sapwood; largely manufactured into lumber used in the construction of buildings; also employed for fuel and charcoal. The bark is sometimes employed in tanning leather.

Fig. 42

Distribution. High mountain slopes, often forming great forests from the mountains of Alberta, British Columbia and Alaska, southward over the interior mountain systems of the continent to southern New Mexico (the Sacramento Mountains) and northern Arizona, from elevations of 5000° at the north up to 11,500° and occasionally to 12,000° at the south, and westward through Montana and Idaho to the eastern slopes of the Cascade Mountains of Washington and Oregon; attaining its greatest size and beauty north of the northern boundary of the United States.

Occasionally planted as an ornamental tree in the New England states and northern Europe, where it grows vigorously and promises to attain a large size; usually injured in western Europe by spring frosts.

5. Picea pungens Engelm. Blue Spruce. Colorado Spruce.

Picea Parryana Sarg.

Leaves strongly incurved, especially those on the upper side of the branches, stout, rigid, acuminate and tipped with long callous sharp points, 1′–$1\frac{1}{8}'$ long on sterile branches, often not more than half as long on the fertile branches of old trees, marked on each side by 4–7 rows of stomata, dull bluish green on some individuals and light or dark steel-blue or silvery white on others, the blue colors gradually changing to dull blue-green at the end of three or four years. **Flowers:** male yellow tinged with red; female with broad oblong or slightly obovate pale green scales truncate or slightly emarginate at the denticulate apex, and acute bracts. **Fruit** produced on the upper third of the tree, sessile or short-stalked, oblong-

cylindric, slightly narrowed at the ends, usually about 3′ long, green more or less tinged with red when fully grown at midsummer, becoming pale chestnut-brown and lustrous, with flat tough rhombic scales flexuose on the margins, and acute, rounded or truncate at the elongated erose apex; seeds $\frac{1}{8}$′ long or about half the length of their wings, gradually widening to above the middle and full and rounded at apex.

A tree, usually 80°–100° or occasionally 150° high, with a trunk rarely 3° in diameter and occasionally divided into 3 or 4 stout secondary stems, rigid horizontal branches disposed on young trees in remote whorls and decreasing regularly in length from below upward, the short stout stiff branchlets pointing forward and making flat-topped masses of foliage; branches on old trees short and remote, with stout lateral branches forming a thin ragged pyramidal crown; branchlets stout, rigid, glabrous, pale glaucous green, becoming bright orange-brown during the first winter and ultimately light grayish brown. **Winter-buds** stout, obtuse or rarely acute, $\frac{1}{4}$′–$\frac{1}{2}$′ long, with thin pale chestnut-brown scales usually reflexed on the margins. **Bark** of young trees gray or gray tinged with cinnamon-red and broken into small oblong plate-like scales, becoming on the lower part of old trunks $\frac{3}{4}$′–$1\frac{1}{2}$′ thick and deeply divided into broad rounded ridges covered with small closely appressed pale gray or occasionally bright cinnamon-red scales. **Wood** light, soft, close-grained, weak, pale brown or often nearly white, with hardly distinguishable sapwood.

Fig. 43

Distribution. Banks of streams or on the first benches above them singly or in small groves at elevations between 6500° and 11,000° above the sea; Colorado and eastern Utah northward to the northern end of the Medicine Bow Mountains and on the Laramie Range in southern and on the Shoshone and Teton Mountains in northwestern Wyoming, and southward into northern New Mexico (Sierra Blanca, alt. 8000°–11,000°, Sacramento Mountains, Pecos River National Forest).

Often planted as an ornamental tree in the eastern and northern states and in western and northern Europe, especially individuals with blue foliage; very beautiful in early life but in cultivation soon becoming unsightly from the loss of the lower branches.

6. Picea Breweriana S. Wats. Weeping Spruce.

Leaves abruptly narrowed and obtuse at apex, straight or slightly incurved, rounded and obscurely ridged and dark green and lustrous on the lower surface, flattened and conspicuously marked on the upper surface by 4 or 5 rows of stomata on each side of the prominent midrib, $\frac{3}{4}$′–$1\frac{1}{8}$′ long, $\frac{1}{16}$′–$\frac{1}{10}$′ wide. **Flowers:** male dark purple; female oblong-cylindric, with obovate scales rounded above and reflexed on the entire margins, and oblong bracts laciniately divided at their rounded or acute apex. **Fruit** ellipsoidal, gradually narrowed from the middle to the ends, acute at apex, rather oblique at base, suspended on straight slender stalks, deep rich purple or green more or less tinged with purple when fully grown, becoming light orange-brown, 2′–4′ long, with thin broadly ovate flat scales longer than broad, rounded at apex, opening late in the autumn after the escape of the

seeds, often becoming strongly reflexed and very flexible; usually remaining on the branches until their second winter; **seeds** acute at base, full and rounded on the sides, $\frac{1}{8}'$ long, dark brown, and about one quarter the length of their wings broadest toward the full and rounded apex.

A tree, usually 80°–100° high, with a trunk 2°–3° in diameter above the swelling of its enlarged and gradually tapering base, and furnished to the ground with crowded branches, those at the top of the tree short and slightly ascending, with comparatively short pendulous lateral branches, those lower on the tree horizontal or pendulous and clothed with slender flexible whip-like laterals often 7°–8° long and not more than $\frac{1}{4}'$ thick and furnished with numerous long thin lateral branchlets, their ultimate divisions slender, coated with fine pubescence persistent until their third season, bright red-brown during their first winter, gradually growing dark gray-brown. **Winter-buds** conic, light chestnut-brown, $\frac{1}{4}'$

Fig. 44

long and $\frac{1}{8}'$ thick. **Bark** $\frac{1}{2}'$–$\frac{3}{4}'$ thick, broken into long thin closely appressed scales dull red-brown on the surface. **Wood** heavy, soft, close-grained, light brown or nearly white, with thick hardly distinguishable sapwood.

Distribution. Dry mountain ridges and peaks near the timber-line on both slopes of the Siskiyou Mountains on the boundary between California and Oregon, forming small groves at elevations of about 7000° above the sea; on a high peak west of Marble Mountain in Siskiyou County, California; on the coast ranges of southwestern Oregon at elevations of 4000°–5000°.

7. Picea sitchensis Carr. Tideland Spruce. Sitka Spruce.

Leaves standing out from all sides of the branches and often nearly at right angles to them, frequently bringing their white upper surface to view by a twist at their base, straight or slightly incurved, acute or acuminate with long callous tips, slightly rounded, green, lustrous, and occasionally marked on the lower surface with 2 or 3 rows of small conspicuous stomata on each side of the prominent midrib, flattened, obscurely ridged and almost covered with broad silvery white bands of numerous rows of stomata on the upper surface, $\frac{1}{2}'$–$1\frac{1}{8}'$ long and $\frac{1}{16}'$–$\frac{1}{12}'$ wide, mostly persistent 9–11 years. **Flowers:** male at the ends of the pendant lateral branchlets, dark red; female on rigid terminal shoots of the branches of the upper half of the tree, with nearly orbicular denticulate scales, often slightly truncate above and completely hidden by their elongated acuminate bracts. **Fruit** oblong-cylindric, short-stalked, yellow-green often tinged with dark red when fully grown, becoming lustrous and pale yellow or reddish brown, $2\frac{1}{2}'$–$4'$ long, with thin stiff elliptic scales rounded toward the apex, denticulate above the middle, and nearly twice as long as their lanceolate den-

ticulate bracts; deciduous mostly during their first autumn and winter; seeds full and rounded, acute at the base, pale reddish brown, about $\frac{1}{8}'$ long, with narrow oblong slightly oblique wings $\frac{1}{3}'$–$\frac{1}{2}'$ in length.

A tree, usually about 100° high, with a conspicuously tapering trunk often 3°–4° in diameter above its strongly buttressed and much-enlarged base, occasionally 200° tall, with a trunk 15°–16° in diameter, horizontal branches forming an open loose pyramid and on older trees clothed with slender pendant lateral branches frequently 2°–3° long, and stout rigid glabrous branchlets pale green at first, becoming dark or light orange-brown during their first autumn and winter and finally dark gray-brown; at the extreme northwestern limits of its range occasionally reduced to a low shrub. Winter-buds ovoid, acute or conical, $\frac{1}{4}'$–$\frac{1}{2}'$ long, with pale chestnut-brown acute scales, often tipped with short points and more or less reflexed above the middle. Bark $\frac{1}{4}'$–$\frac{1}{2}'$ thick and broken on the surface into large thin loosely attached dark red-brown or on young trees sometimes bright cinnamon-red scales. Wood light, soft, not strong, straight-grained, light brown tinged with red, with thick nearly white sapwood; largely manufactured into lumber used in the interior finish of buildings, for fencing, boat-building, aeroplanes, cooperage, wooden-ware, and packing-cases.

Fig. 45

Distribution. Moist sandy, often swampy soil, or less frequently at the far north on wet rocky slopes, from the eastern end of Kadiak Island, southward through the coast region of Alaska, British Columbia, Washington, and Oregon to Mendocino County, California; in Washington, occasionally ranging inland to the upper valley of the Nesqually River.

Often planted in western and central Europe and occasionally in the middle Atlantic states as an ornamental tree.

4. TSUGA Carr. Hemlock.

Tall pyramidal trees, with deeply furrowed astringent bark bright cinnamon-red except on the surface, soft pale wood, nodding leading shoots, slender scattered horizontal often pendulous branches, the secondary branches three or four times irregularly pinnately ramified, with slender round glabrous or pubescent ultimate divisions, the whole forming graceful pendant masses of foliage, and minute winter-buds. Leaves flat or angular, obtuse and often emarginate or acute at apex, spirally disposed, usually appearing almost 2-ranked by the twisting of their petioles, those on the upper side of the branch then much shorter than the others, abruptly narrowed into short petioles jointed on ultimately woody persistent bases, with stomata on the lower surface; on one species not 2-ranked, and of nearly equal length, with stomata on both surfaces. Flowers solitary, the male in the axils of leaves of the previous year, globose, composed of numerous subglobose anthers, with connectives produced into short gland-like tips, the female terminal, erect, with nearly circular scales slightly longer or shorter than their membranaceous bracts. Fruit

an ovoid-oblong, oval, or oblong-cylindric obtuse usually pendulous nearly sessile green or rarely purple cone becoming light or dark reddish brown, with concave suborbicular or ovate-oblong scales thin and entire on the margins, much longer than their minute bracts, persistent on the axis of the cone after the escape of the seeds. Seeds furnished with resin-vesicles, ovoid-oblong, compressed, nearly surrounded by their much longer obovate-oblong wings; outer seed-coat crustaceous, light brown, the inner membranaceous, pale chestnut-brown, and lustrous; cotyledons 3–6, much shorter than the inferior radicle.

Tsuga is confined to temperate North America, Japan, central and southwestern China, Formosa, and the Himalayas; nine species have been distinguished.

Tsuga is the Japanese name of the Hemlock-tree.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Leaves flat, obtuse or emarginate at apex, with stomata only on the lower surface; cones ovoid, oblong or oblong-ovoid.

Cones stalked.

Cone-scales broad-obovate, about as wide as long, their bracts broad and truncate. **1. T. canadensis** (A).

Cone-scales narrow-oval, much longer than wide, their bracts obtusely pointed. **2. T. caroliniana** (A).

Cones sessile; cone-scales oval, often abruptly contracted near the middle, their bracts gradually narrowed to an obtuse point. **3. T. heterophylla** (B, F, G).

Leaves convex or keeled above, bluntly pointed, with stomata on both surfaces; cones oblong-cylindric, their scales oblong-obovate, longer than broad, much longer than their acuminate short-pointed bracts. **4. T. Mertensiana** (B, F, G).

1. Tsuga canadensis Carr. Hemlock.

Leaves, rounded and rarely emarginate at apex, dark yellow-green, lustrous and obscurely grooved especially toward the base on the upper surface, marked on the lower surface by 5 or 6 rows of stomata on each side of the low broad midrib, $\frac{1}{3}'$–$\frac{2}{3}'$ long, about $\frac{1}{16}'$

Fig. 46

wide, deciduous in their third season from dark orange-colored persistent bases. **Flowers:** male light yellow; female pale green, with broad bracts coarsely laciniate on the margins and shorter than their scales. **Fruit** on slender puberulous stalks often $\frac{1}{4}'$ long, ovoid, acute, $\frac{1}{2}'$–$\frac{3}{4}'$ long, with broad-obovate scales almost as wide as long, and broad truncate bracts slightly laciniate on the margins, opening and gradually losing their seeds during

the winter and mostly persistent on the branches until the following spring; **seeds** $\frac{1}{16}'$ long, usually with 2 or 3 large oil-vesicles, nearly half as long as their wings broad at the base and gradually tapering to the rounded apex.

A tree, usually 60°–70°, and occasionally 100° high, with a trunk 2°–4° in diameter, gradually and conspicuously tapering toward the apex, long slender horizontal or pendulous branches, persistent until overshadowed by other trees, and forming a broad-based rather obtuse pyramid, and slender light yellow-brown pubescent branchlets, growing darker during their first winter and glabrous and dark red-brown tinged with purple in their third season. **Winter-buds** obtuse, light chestnut-brown, slightly puberulous, about $\frac{1}{16}'$ long. **Bark** $\frac{1}{2}'$–$\frac{3}{4}'$ thick, deeply divided into narrow rounded ridges covered with thick closely appressed scales varying from cinnamon-red to gray more or less tinged with purple. **Wood** light, soft, not strong, brittle, coarse-grained, difficult to work, liable to wind-shake and splinter, not durable when exposed to the air, light brown tinged with red, with thin somewhat darker sapwood; largely manufactured into coarse lumber employed for the outside finish of buildings. The astringent inner bark affords the largest part of the material used in the northeastern states and Canada in tanning leather. From the young branches oil of hemlock is distilled.

Distribution. Scattered through upland forests and often covering the northern slopes of rocky ridges and the steep rocky banks of narrow river-gorges from Nova Scotia to eastern Minnesota (Carleton County), and southward through the northern states to Newcastle County, Delaware, cliffs of Tuckahoe Creek, Queen Anne's County, Maryland, southern Michigan, southern Indiana (bank of Back Creek near Leesville, Laurence County), southwestern Wisconsin, and along the Appalachian Mountains to northern Georgia, and in northern Alabama; most abundant and frequently an important element of the forest in New England, northern New York, and western Pennsylvania; attaining its largest size near streams on the slopes of the high mountains of North Carolina and Tennessee.

Largely cultivated with numerous seminal varieties as an ornamental tree in the northern states, and in western and central Europe.

2. Tsuga caroliniana Engelm. Hemlock.

Leaves retuse or often emarginate at apex, dark green, lustrous and conspicuously grooved on the upper surface, marked on the lower surface by a band of 7 or 8 rows of stomata on each side of the midrib, $\frac{1}{3}'$–$\frac{3}{4}'$ long, about $\frac{1}{12}'$ wide, deciduous from the orange-red bases during their fifth year. **Flowers:** male tinged with purple; female purple, with broadly ovate bracts, scarious and erose on the margins and about as long as their scales. **Fruit** on short stout stalks, oblong, 1′–$1\frac{1}{2}'$ long, with narrow-oval scales gradually narrowed and rounded at apex, rather abruptly contracted at base into distinct stipes, thin, concave, puberulous on the outer surface, twice as long as their broad pale bracts, spreading nearly at right angles to the axis of the cone

Fig. 47

at maturity, their bracts rather longer than wide, wedge-shaped, pale, nearly truncate or slightly pointed at the broad apex; seeds $\frac{1}{8}'$ long, with numerous small oil-vesicles on the lower side, and one quarter as long as the pale lustrous wings broad or narrow at the base and narrowed to the rounded apex.

A tree, usually 40°–50°, or occasionally 70° high, with a trunk rarely exceeding 2° in diameter, short stout often pendulous branches forming a handsome compact pyramidal head, and slender light orange-brown pubescent branchlets, usually becoming glabrous and dull brown more or less tinged with orange during their third year. **Winter-buds** obtuse, dark chestnut-brown, pubescent, nearly $\frac{1}{8}'$ long. **Bark** of the trunk $\frac{3}{4}'$–$1\frac{1}{4}'$ thick, red-brown, and deeply divided into broad flat connected ridges covered with thin closely appressed plate-like scales. **Wood** light, soft, not strong, brittle, coarse-grained, pale brown tinged with red, with thin nearly white sapwood.

Distribution. Rocky banks of streams usually at elevations between 2500° and 4000° on the Blue Ridge from southwestern Virginia to northern Georgia, generally singly or in small scattered groves of a few individuals.

Occasionally planted as an ornamental tree in the northern states, and in western Europe.

3. Tsuga heterophylla Sarg. Hemlock.

Leaves rounded at apex, conspicuously grooved, dark green and very lustrous on the upper surface, marked below by broad white bands of 7–9 rows of stomata, abruptly contracted at the base into slender petioles, $\frac{1}{4}'$–$\frac{3}{4}'$ long and $\frac{1}{16}'$–$\frac{1}{12}'$ wide, mostly persistent

Fig. 48

4–7 years. **Flowers:** male yellow; female purple and puberulous, with broad bracts gradually narrowed to an obtuse point and shorter than their broadly ovate slightly scarious scales. **Fruit** oblong-ovoid, acute, sessile, $\frac{3}{4}'$–$1'$ long, with slightly puberulous oval scales, often abruptly narrowed near the middle, and dark purple puberulous bracts rounded and abruptly contracted at apex; seeds $\frac{1}{8}'$ long, furnished with occasional oil-vesicles, one third to one half as long as their narrow wings.

A tree, frequently 200° high, with a tall trunk 6°–10° in diameter, and short slender usually pendulous branches forming a narrow pyramidal head, and slender pale yellow-brown branchlets ultimately becoming dark reddish brown, coated at first with long pale hairs, and pubescent or puberulous for five or six years. **Winter-buds** ovoid, bright chestnut-brown, about $\frac{1}{16}'$ long. **Bark** on young trunks thin, dark orange-brown, and

separated by shallow fissures into narrow flat plates broken into delicate scales, becoming on fully grown trees 1′–1½′ thick and deeply divided into broad flat connected ridges covered with closely appressed brown scales more or less tinged with cinnamon-red. **Wood** light, hard and tough, pale brown tinged with yellow, with thin nearly white sapwood; stronger and more durable than the wood of the other American hemlocks; now largely manufactured into lumber used principally in the construction of buildings. The bark is used in large quantities in tanning leather; from the inner bark the Indians of Alaska obtain one of their principal articles of vegetable food.

Distribution. Southeastern Alaska, southward near the coast to southern Mendocino County, California, extending eastward over the mountains of southern British Columbia, northern Washington, Idaho and Montana, to the western slopes of the continental divide, and through Oregon to the western slopes of the Cascade Mountains, sometimes ascending in the interior to elevations of 6000° above the sea; most abundant and of its largest size on the coast of Washington and Oregon; often forming a large part of the forests of the northwest coast.

Frequently planted as an ornamental tree in temperate Europe.

4. Tsuga Mertensiana Sarg. Mountain Hemlock. Black Hemlock.

Leaves standing out from all sides of the branch, remote on leading shoots and crowded on short lateral branchlets, rounded and occasionally obscurely grooved or on young plants sometimes conspicuously grooved on the upper surface, rounded and slightly ribbed

Fig. 49

on the lower surface, bluntly pointed, often more or less curved, stomatiferous above and below, with about 8 rows of stomata on each surface, light bluish green or on some individuals pale blue, ½′–1′ long, about $\frac{1}{16}$′ wide, abruptly narrowed into nearly straight or slightly twisted petioles articulate on bases as long or rather longer than the petioles; irregularly deciduous during their third and fourth years. **Flowers:** male borne on slender pubescent drooping stems, violet-purple; female erect, with delicate lustrous dark purple or yellow-green bracts gradually narrowed above into slender often slightly reflexed tips and much longer than their scales. **Fruit** sessile, oblong-cylindric, narrowed toward the blunt apex and somewhat toward the base, erect until more than half grown, pendulous or rarely erect at maturity, ⅝′–3′ long, with thin delicate oblong-obovate scales gradually contracted from above the middle to the wedge-shaped base, rounded at the slightly thickened more or less erose margins, puberulous on the outer surface, usually bright bluish purple or occasionally pale yellow-green, four or five times as long as their short-pointed dark purple or brown bracts; **seeds** light brown, ⅛′ long, often marked on the

surface next their scales with 1 or 2 large resin-vesicles, with wings nearly $\frac{1}{2}'$ long, broadest above the middle, gradually narrowed below, slightly or not at all oblique at the rounded apex.

A tree, usually 70°–100° but occasionally 150° high, with a slightly tapering trunk 4°–5° in diameter, gracefully pendant slender branches furnished with drooping frond-like lateral branches, their ultimate divisions erect and forming an open pyramid surmounted by the long drooping leading shoot, and thin flexible or sometimes stout rigid branchlets light reddish brown and covered for two or three years with short pale dense pubescence, becoming grayish brown and very scaly. **Winter-buds** acute, about $\frac{1}{8}'$ long, the scales of the outer ranks furnished on the back with conspicuous midribs produced into slender deciduous awl-like tips. **Bark** $1'$–$1\frac{1}{2}'$ thick, deeply divided into connected rounded ridges broken into thin closely appressed dark cinnamon scales shaded with blue or purple. **Wood** light, soft, not strong, close-grained, pale brown or red, with thin nearly white sap-wood; occasionally manufactured into lumber.

Distribution. Exposed ridges and slopes at high altitudes along the upper border of the forest from southeastern Alaska, southward over the mountain ranges of British Columbia to the Olympic Mountains of Washington, and eastward to the western slopes of the Selkirk Mountains in the interior of southern British Columbia, and along the Bitter Root Mountains to the headwaters of the Clearwater River, Idaho; along the Cascade Mountains of Washington and Oregon, on the mountain ranges of northern California, and along the high Sierra Nevada to the cañon of the south fork of King's River, California; in Alaska occasionally descending to the sea-level, and toward the southern limits of its range often ascending to elevations of 10,000°.

Often planted as an ornamental tree in western and central Europe, and rarely in the eastern United States.

5. PSEUDOTSUGA Carr.

Pyramidal trees, with thick deeply furrowed bark, hard strong wood, with spirally marked wood-cells, slender usually horizontal irregularly whorled branches clothed with slender spreading lateral branches forming broat flat-topped masses of foliage, ovoid acute leaf-buds, the lateral buds in the axils of upper leaves, their inner scales accrescent and marking the branchlets with ring-like scars. Leaves petiolate, linear, flat, rounded and obtuse or acuminate at apex, straight or incurved, grooved on the upper side, marked on the lower side by numerous rows of stomata on each side of the prominent midrib, spreading nearly at right angles with the branch. Flowers solitary, the male axillary, scattered along the branches, oblong-cylindric, with numerous globose anthers, their connectives terminating in short spurs, the female terminal or in the axils of upper leaves, composed of spirally arranged ovate rounded scales much shorter than their acutely 2-lobed bracts, with midribs produced into elongated slender tips. Fruit an ovoid-oblong acute pendulous cone maturing in one season, with rounded concave rigid scales persistent on the axis of the cone after the escape of the seeds, and becoming dark red-brown, much shorter than the 2-lobed bracts with midribs ending in rigid woody linear awns, those at the base of the cone without scales and becoming linear-lanceolate by the gradual suppression of their lobes. Seeds nearly triangular, full, rounded and dark-colored on the upper side and pale on the lower side, shorter than their oblong wings infolding the upper side of the seeds in a dark covering; outer seed-coat thick and crustaceous, the inner thin and membranaceous; cotyledons 6–12, much shorter than the inferior radicle.

Pseudotsuga is confined to western North America, southern Japan, southwestern China and Formosa. Four species are recognized.

Pseudotsuga, a barbarous combination of a Greek with a Japanese word, indicates the relation of these trees with the Hemlocks.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Leaves usually rounded and obtuse at apex, dark yellow-green or rarely blue-green; cones 2′–4½′ long, their bracts much exserted. 1. **P. taxifolia** (B, E, F, G, H).

Leaves acuminate at apex, bluish gray; cones 4′–6½′ long, their bracts slightly exserted. 2. **P. macrocarpa** (G).

1. Pseudotsuga taxifolia Britt. Douglas Spruce. Red Fir.

Pseudotsuga mucronata Sudw.

Leaves straight or rarely slightly incurved, rounded and obtuse at apex, or acute on leading shoots, ¾′–1¼′ long, $\frac{1}{16}$′–$\frac{1}{12}$′ wide, dark yellow-green or rarely light or dark bluish green, occasionally persistent until their sixteenth year. **Flowers:** male orange-red; female with slender elongated bracts deeply tinged with red. **Fruit** pendant on long stout stems, 4′–6½′ long, with thin slightly concave scales rounded and occasionally somewhat elongated at apex, usually rather longer than broad, when fully grown at midsummer slightly puberulous, dark blue-green below, purplish toward the apex, bright red on the closely appressed margins, and pale green bracts becoming slightly reflexed above the middle, ⅛′–¼′ wide, often extending ½′ beyond the scales; **seeds** light reddish brown and lustrous above, pale and marked below with large irregular white spots, ¼′ long, nearly ⅛′ wide, almost as long as their dark brown wings broadest just below the middle, oblique above and rounded at the apex.

Fig. 50

A tree, often 200° high, with a trunk 3°–4° in diameter, frequently taller, with a trunk 10°–12° in diameter, but in the dry interior of the continent rarely more than 80°–100° high, with a trunk hardly exceeding 2°–3° in diameter, slender crowded branches densely clothed with long pendulous lateral branches, forming while the tree is young an open pyramid, soon deciduous from trees crowded in the forest, often leaving the trunk naked for two thirds of its length and surmounted by a comparatively small narrow head sometimes becoming flap-topped by the lengthening of the upper branches, and slender branchlets pubescent for three or four years, pale orange color and lustrous during their first season, becoming bright reddish brown and ultimately dark gray-brown. **Winter-buds** ovoid, acute, the terminal bud often ¼′ long and nearly twice as large as the lateral buds. **Bark** on young trees smooth, thin, rather lustrous, dark gray-brown, usually becoming on old trunks 10′–12′ thick, and divided into oblong plates broken into great broad rounded and irregularly connected ridges separating on the surface into small thick closely ap-

pressed dark red-brown scales. **Wood** light, red or yellow, with nearly white sapwood; very variable in density, quality, and in the thickness of the sapwood; largely manufactured into lumber in British Columbia, western Washington and Oregon, and used for all kinds of construction, fuel, railway-ties, and piles; known commercially as "Oregon pine." The bark is sometimes used in tanning leather.

Distribution. From about latitude 55° north in the Rocky Mountains and from the head of the Skeena River in the coast range, southward through all the Rocky Mountain system to the mountains of western Texas, southern New Mexico and Arizona, and of northern Mexico, and from the Big Horn and Laramie Ranges in Wyoming and from eastern base of the Rocky Mountains of Colorado to the Pacific coast, but absent from the arid mountains in the great basin between the Wahsatch and the Sierra Nevada ranges and from the mountains of southern California; most abundant and of its largest size near the sea-level in the coast region of southern British Columbia and of Washington and Oregon, and on the western foothills of the Cascade Mountains; ascending on the California Sierras to elevations of 5500°, and on the mountains of Colorado to between 6000° and 11,000°, above the sea.

Often planted for timber and ornament in temperate Europe, and for ornament in the eastern and northern states, where only the form from the interior of the continent flourishes. (*P. glauca Mayr.*)

2. Pseudotsuga macrocarpa Mayr. Hemlock.

Leaves acute or acuminate, terminating in slender rigid callous tips, apparently 2-ranked by the conspicuous twist of their petioles, incurved above the middle, $\frac{3}{4}'$–$1\frac{1}{4}'$ long, about $\frac{1}{15}'$ wide, dark bluish gray. **Flowers:** male pale yellow, inclosed for half their length

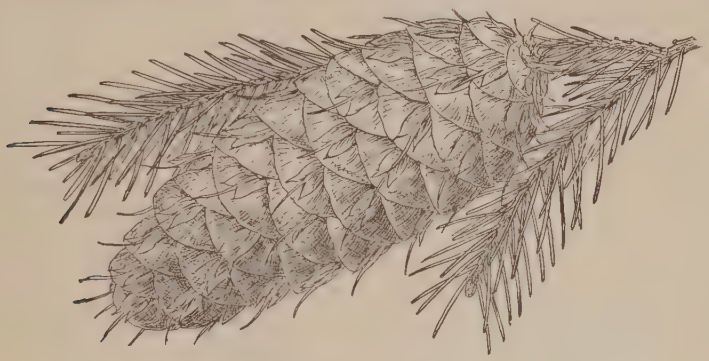

Fig. 51

in conspicuous involucres of the lustrous bud-scales; female with pale green bracts tinged with red. **Fruit** produced on the upper branches and occasionally on those down to the middle of the tree, short-stalked, with scales near the middle of the cone $1\frac{1}{2}'$–$2'$ across, stiff, thick, concave, rather broader than long, rounded above, abruptly wedge-shaped at the base, puberulous on the outer surface, often nearly as long as their comparatively short and narrow bracts with broad midribs produced into short flattened flexible tips; **seeds** full and rounded on both sides, rugose, dark chestnut-brown or nearly black and lustrous above, pale reddish brown below, $\frac{1}{2}'$ long, $\frac{3}{8}'$ wide, with a thick brittle outer coat, and wings broadest near the middle, about $\frac{1}{2}'$ long, nearly $\frac{1}{4}'$ wide, and rounded at the apex.

A tree, usually 40°–50° and rarely 90° high, with a trunk 3°–4° in diameter, remote elongated branches pendulous below, furnished with short stout pendant or often erect laterals forming an open broad-based symmetrical pyramidal head, slender branchlets dark reddish

brown and pubescent during their first year, becoming glabrous and dark or light orange-brown and ultimately gray-brown. **Winter buds** ovoid, acute, usually not more than $\frac{1}{8}'$ long, often nearly as broad as long. **Bark** 3′–6′ thick, dark reddish brown, deeply divided into broad rounded ridges covered with thick closely appressed scales. **Wood** heavy, hard, strong, close-grained, not durable; occasionally manufactured into lumber; largely used for fuel.

Distribution. Steep rocky mountain slopes in southern California at elevations of 3000°–5000° above the sea, often forming open groves of considerable extent, from the Santa Inez Mountains in Santa Barbara County to the Cuyamaca Mountains.

6. ABIES Link. Fir.

Tall pyramidal trees, with bark containing numerous resin-vesicles, smooth, pale, and thin on young trees, often thick and deeply furrowed in old age, pale and usually brittle wood, slender horizontal wide-spreading branches in regular remote 4 or 5-branched whorls, clothed with twice or thrice forked lateral branches forming flat-topped masses of foliage gradually narrowed from the base to the apex of the branch, the ultimate divisions stout, glabrous or pubescent, and small subglobose or ovoid winter branch-buds usually thickly covered with resin, or in one species large and acute, with thin loosely imbricated scales. Leaves linear, sessile, on young plants and on lower sterile branches flattened and mostly grooved on the upper side, or in one species 4-sided, rounded and usually emarginate at apex, appearing 2-ranked by a twist near their base or occasionally spreading from all sides of the branch, only rarely stomatiferous above, on upper fertile branches and leading shoots usually crowded, more or less erect, often incurved or falcate, thick, convex on the upper side, or quadrangular in some species and then obtuse, or acute at apex and frequently stomatiferous on all sides; persistent usually for eight or ten years, in falling leaving small circular scars. Flowers axillary, from buds formed the previous season on branchlets of the year, surrounded at the base by conspicuous involucres of enlarged bud-scales, the male very abundant on the lower side of branches above the middle of the tree, oval or oblong-cylindric with yellow or scarlet anthers surmounted by short knob-like projections, the female usually on the upper side only of the topmost branches, or in some species scattered also over the upper half of the tree, erect, globose, ovoid or oblong, their scales imbricated in many series, obovate, rounded above, cuneate below, much shorter than their acute or dilated mucronate bracts. Fruit an erect ovoid or oblong-cylindric cone, its scales closely imbricated, thin, incurved at the broad apex and generally narrowed below into long stipes, decreasing in size and sterile toward the ends of the cone, falling at maturity with their bracts and seeds from the stout tapering axis of the cone long-persistent on the branch. Seeds furnished with large conspicuous resin-vesicles, ovoid or oblong, acute at base, covered on the upper side and infolded below on the lower side by the base of their thin wing abruptly enlarged at the oblique apex; seed-coat thin, of 2 layers, the outer thick, coriaceous, the inner membranaceous; cotyledons 4–10, much shorter than the inferior radicle.

Abies is widely distributed in the New World from Labrador and the valley of the Athabasca River to the mountains of North Carolina, and from Alaska through the Pacific and Rocky Mountain regions to the highlands of Guatemala, and in the Old World from Siberia and the mountains of central Europe to southern Japan, central China, Formosa, the Himalayas, Asia Minor, and the highlands of northern Africa. Thirty-three species are now recognized. Several exotic species are cultivated in the northern and eastern states; of these the best known and most successful as ornamental trees are *Abies Nordmanniana*, Spach, of the Caucasus, *Abies cilicica* Carr., of Asia Minor, *Abies cephalonica* Loud., a native of Cephalonia, *Abies Veitchii* Lindl., and *Abies homolepis* S. & Z., of Japan, and *Abies pinsapo*, Boiss., of the Spanish Sierra Nevada.

Abies is the classical name of the Fir-tree.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Winter-buds subglobose, with closely imbricated scales.

Leaves flat and grooved above, with stomata on the lower surface (in Nos. 3 and 5, also on the upper surface), rounded and often notched, or on fertile branches frequently acute at apex.

Leaves on sterile branches spreading, not crowded.

Cones purple.

Leaves dark green and lustrous above, pale below.

Bracts of the cone-scales much longer than their scales, reflexed.

1. **A. Fraseri** (A).

Bracts of the cone-scales shorter or rarely slightly longer than their scales.

2. **A. balsamea** (A).

Leaves pale blue-green, stomatose above. 3. **A. lasiocarpa** (B, F, G).

Cones green (green, yellow, and purple in No. 5).

Leaves dark green and lustrous above, pale below. 4. **A. grandis** (B, G).

Leaves pale blue or glaucous, often stomatose above on the upper surface.

5. **A. concolor** (F, G, H).

Leaves on sterile branches pointing forward, densely crowded, dark green and lustrous above, pale below. 6. **A. amabilis** (B, G).

Leaves often 4-sided, with stomata on all surfaces, blue-green, usually glaucous, bluntly pointed or acute, incurved and crowded on fertile branches; cones purple.

Leaves of sterile branches flattened and distinctly grooved above; bracts of the cone-scales rounded and fimbriate above, long-pointed, incurved, light green, much longer than and covering their scales. 7. **A. nobilis** (G).

Leaves of sterile branches 4-sided; bracts of the cone-scales acute or acuminate or rounded above, with slender tips shorter or longer than their scales.

8. **A. magnifica** (G).

Winter-buds acuminate, with loosely imbricated scales; bracts of the cone-scales produced into elongated ridged flat tips many times longer than the obtusely pointed scales; leaves acuminate, dark yellow-green above, white below, similar on sterile and fertile branches. 9. **A. venusta** (G).

1. Abies Fraseri Poir., Balsam Fir. She Balsam.

Leaves obtusely short-pointed or occasionally slightly emarginate at apex, dark green and lustrous on the upper surface, marked on the lower surface by wide bands of 8–12

Fig. 52

rows of stomata, ½′ to nearly 1′ long, about $\frac{1}{16}$′ wide. **Flowers:** male yellow tinged with red; female with scales rounded above, much broader than long and shorter than their oblong pale yellow-green bracts rounded at the broad apex terminating in a slender elongated tip. **Fruit** oblong-ovoid or nearly oval, rounded at the somewhat narrowed apex, dark purple, puberulous, about 2½′ long, with scales twice as wide as long, at maturity nearly half covered by their pale yellow-green reflexed bracts; **seeds** ⅛′ long, with dark lustrous wings much expanded and very oblique at apex.

A tree, usually 30°–40° and rarely 70° high, with a trunk occasionally 2½° in diameter, and rather rigid branches forming an open symmetrical pyramid and often disappearing early from the lower part of the trunk, and stout branchlets pubescent for three or four years, pale yellow-brown during their first season, becoming dark reddish brown often tinged with purple, and obtuse orange-brown winter-buds. **Bark** ¼′–½′ thick, covered with thin closely appressed bright cinnamon-red scales, generally becoming gray on old trees. **Wood** light, soft, not strong, coarse-grained, pale brown, with nearly white sapwood; occasionally manufactured into lumber.

Distribution. Appalachian Mountains; Cheat Mountain, near Cheat Bridge, Randolph County, West Virginia, and from southwestern Virginia to western North Carolina and eastern Tennessee, often forming forests of considerable extent at elevations between 4000° and 6000° above the sea-level.

Occasionally planted in the parks and gardens of the northern states and of Europe, but short-lived in cultivation and of little value as an ornamental tree.

2. Abies balsamea Mill. Balsam Fir.

Leaves dark green and lustrous on the upper surface, silvery white on the lower surface, with bands of 4–8 rows of stomata, ½′ long on cone-bearing branches to 1¼′ long on the sterile branches of young trees, straight, acute or acuminate, with short or elongated rigid

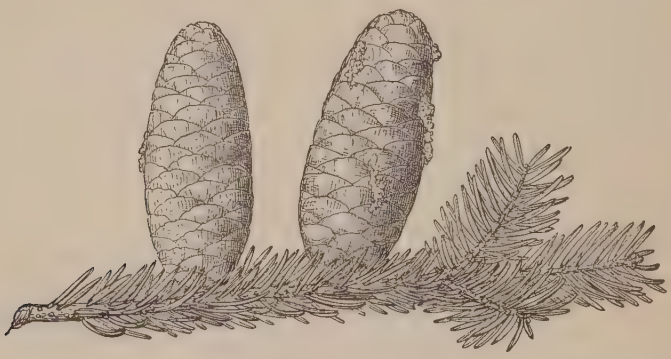

Fig. 53

callous tips, spreading at nearly right angles to the branch on young trees and sterile branches, on the upper branches of older trees often broadest above the middle, rounded or obtusely short-pointed at apex, occasionally emarginate on branches at the top of the tree. **Flowers:** male yellow, more or less deeply tinged with reddish purple; female with nearly orbicular purple scales much shorter than their oblong-obovate serrulate pale yellow-green bracts emarginate with a broad apex abruptly contracted into a long slender recurved tip. **Fruit** oblong-cylindric, gradually narrowed to the rounded apex, puberulous, dark rich purple, 2′–4′ long, with scales usually longer than broad, generally almost twice as long; rarely not as long as their bracts, (var. *phanerolepis* Fern.); **seeds** about ¼′ long and rather shorter than their light brown wings.

A tree, 50°–60° high, with a trunk usually 12′–18′, or rarely 30′ in diameter, spreading branches forming a handsome symmetrical slender pyramid, the lower branches soon dying from trees crowded in the forest, and slender branchlets pale yellow-green and coated with fine pubescence at first, becoming light gray tinged with red, and often when four or five years old with purple. **Winter-buds** nearly globose, $\frac{1}{8}$′–$\frac{1}{4}$′ in diameter, with lustrous dark orange-green scales. **Bark** on old trees often $\frac{1}{2}$′ thick, rich brown, much broken on the surface into small plates covered with scales. **Wood** light, soft, not strong, coarse-grained, perishable, pale brown streaked with yellow, with thick lighter colored sapwood; occasionally made into lumber principally used for packing-cases. From the bark of this tree oil of fir used in the arts and in medicine is obtained.

Distribution. From the interior of the Labrador peninsula westward to the shores of Lesser Slave Lake, southward through Newfoundland, the maritime provinces of Canada, Quebec and Ontario, northern New England, northern New York, northern Michigan to the shores of Saginaw Bay, and northern Minnesota and northeastern Iowa, and along the Appalachian Mountains from western Massachusetts and the Catskills of New York to the high mountains of southwestern Virginia; common and often forming a considerable part of the forest on low swampy ground; on well-drained hillsides sometimes singly in forests of spruce or forming small almost impenetrable thickets; in northern Wisconsin and vicinity occurs a form with longer and more crowded leaves and larger cones (var. *macrocarpa* Kent); near the timber-line on the mountains of New England and New York reduced to a low almost prostrate shrub.

Sometimes planted in the northern states in the neighborhood of farmhouses, but usually short-lived and of little value as an ornamental tree in cultivation; formerly but now rarely cultivated in European plantations; a dwarf form (var. *hudsonia* Sarg.) growing only a few inches high and spreading into broad nests is often cultivated.

3. Abies lasiocarpa Nutt. Balsam Fir.

Leaves marked on the upper surface but generally only above the middle with 4 or 5 rows of stomata on each side of the conspicuous midrib and on the lower surface by 2 broad bands each of 7 or 8 rows, crowded, nearly erect by the twist at their base, on lower branches 1′–1$\frac{3}{4}$′ long, about $\frac{1}{12}$′ wide, and rounded and occasionally emarginate at apex, on upper branches somewhat thickened, usually acute, generally not more than $\frac{1}{2}$′ long, on leading shoots flattened, closely appressed, with long slender rigid points. **Flowers:** male dark indigo-blue, turning violet when nearly ready to open; female with dark violet-purple obovate scales much shorter than their strongly reflexed bracts contracted into slender tips. **Fruit** oblong-cylindric, rounded, truncate or depressed at the narrowed apex, dark purple, puberulous, 2$\frac{1}{2}$′–4′ long, with scales gradually narrowed from the broad rounded or nearly truncate apex to the base, usually longer than broad, about three times as long as their oblong-obovate red-brown bracts laciniately cut on the margins, rounded, emarginate and abruptly contracted at the apex into long slender tips; **seeds** $\frac{1}{4}$′ long, with dark lustrous wings covering nearly the entire surface of the scales.

A tree, usually 80°–100°, occasionally 175°, or southward rarely more than 50° high, with a trunk 2°–5° in diameter, short crowded tough branches, usually slightly pendulous near the base of the tree, generally clothing the trunks of the oldest trees nearly to their base and forming dense spire-like slender heads, and comparatively stout branchlets coated for three or four years with fine rufous pubescence, or rarely glabrous before the end of their first season, pale orange-brown, ultimately gray or silvery white. **Winter-buds** subglobose, $\frac{1}{8}$′–$\frac{1}{4}$′ thick, covered with light orange-brown scales. **Bark** becoming on old trees $\frac{3}{4}$′–1$\frac{1}{2}$′ thick, divided by shallow fissures and roughened by thick closely appressed cinnamon-red scales; on the San Francisco Mountains, Arizona, thicker and spongy (var. *arizonica* Lem.). **Wood** light, soft, not strong, pale brown or nearly white, with light-colored sapwood; little used except for fuel.

Distribution. High mountain slopes and summits from about latitude 61° in Alaska, southward along the coast ranges to the Olympic Mountains of Washington, over all the

high mountain ranges of British Columbia and Alberta, and southward along the Cascade Mountains of Washington and Oregon to the neighborhood of Crater Lake, over

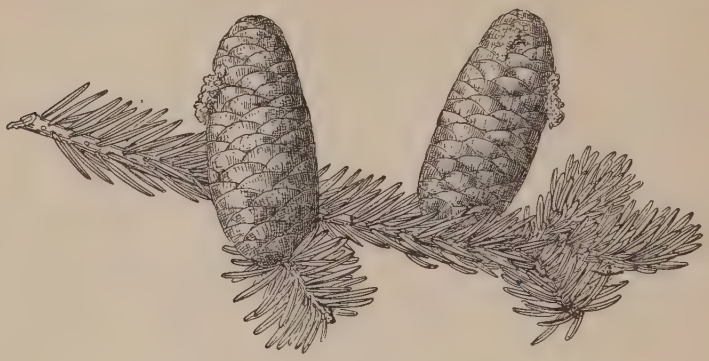

Fig. 54

the mountain ranges of eastern Washington and Oregon, and of Idaho, Wyoming, Colorado, and Utah to the San Francisco peaks of northern Arizona, and on the Sandia and Mogollon Mountains of New Mexico. This southern form is now often considered a species as *Abies arizonica* Merr.

Occasionally planted as an ornamental tree in the northern United States and in northern Europe, but of little value in cultivation.

4. Abies grandis Lindl. White Fir.

Leaves thin and flexible, deeply grooved very dark green and lustrous on upper surface, silvery white on lower surface, with two broad bands of 7–10 rows of stomata, on sterile branches remote, rounded and conspicuously emarginate at apex, $1\frac{1}{2}'$–$2\frac{1}{4}'$ long, usu-

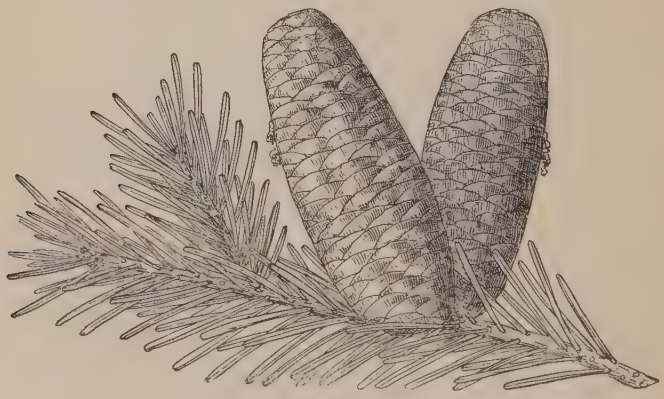

Fig. 55

ally about $\frac{1}{8}'$ wide, spreading in two ranks nearly at right angles to the branch, on cone-bearing branches more crowded, usually $1'$–$1\frac{1}{2}'$ long, less spreading or nearly erect, blunt-pointed or often notched at apex, on vigorous young trees $\frac{1}{2}'$–$\frac{3}{4}'$ long, acute or acumi-

nate, usually persistent 4–10 years. **Flowers:** male pale yellow sometimes tinged with purple; female light yellow-green, with semiorbicular scales and short-oblong bracts emarginate and denticulate at the broad obcordate apex furnished with a short strongly reflexed tip. **Fruit** cylindric, slightly narrowed to the rounded and sometimes retuse apex, puberulous, bright green, 2′–4′ long, with scales usually about two thirds as long as wide, gradually or abruptly narrowed from their broad apex and three or four times as long as their short pale green bracts; **seeds** $\frac{3}{8}'$ in length, light brown, with pale lustrous wings $\frac{1}{2}'$–$\frac{5}{8}'$ long and nearly as broad as their abruptly widened rounded apex.

A tree, in the neighborhood of the coast 250°–300° high, with a slightly tapering trunk often 4° in diameter, long somewhat pendulous branches sweeping out in graceful curves, and comparatively slender pale yellow-green puberulous branchlets becoming light reddish brown or orange-brown and glabrous in their second season; on the mountains of the interior rarely more than 100° tall, with a trunk usually about 2° in diameter, often smaller and much stunted at high elevations. **Winter-buds** subglobose, $\frac{1}{8}'$–$\frac{1}{4}'$ thick. **Bark** becoming sometimes 2′ thick at the base of old trees and gray-brown or reddish brown and divided by shallow fissures into low flat ridges broken into oblong plates roughened by thick closely appressed scales. **Wood** light, soft, coarse-grained, not strong nor durable, light brown, with thin lighter colored sapwood; occasionally manufactured into lumber in western Washington and Oregon and used for the interior finish of buildings, packing-cases, and wooden-ware.

Distribution. Northern part of Vancouver Island southward in the neighborhood of the coast to northern Sonoma County, California, and along the mountains of northern Washington and Idaho to the western slopes of the continental divide in northern Montana, and to the mountains of eastern Oregon; near the coast scattered on moist ground through forests of other conifers; common in Washington and northern Oregon from the sea up to elevations of 4000°; in the interior on moist slopes in the neighborhood of streams from 2500° up to 7000° above the sea; in California rarely ranging more than ten miles inland or ascending to altitudes of more than 1500° above the sea.

Occasionally planted in the parks and gardens of temperate Europe, where it grows rapidly and promises to attain a large size; rarely planted in the United States.

5. Abies concolor Lindl. & Gord. White Fir.

Leaves crowded, spreading in 2 ranks and more or less erect from the strong twist at their base, pale blue or glaucous, becoming dull green at the end of two or three years, with 2 broad bands of stomata on the lower, and more or less stomatiferous on the upper surface, on lower branches flat, straight, rounded, acute or acuminate at apex, 2′–3′ long, about $\frac{1}{18}'$ wide, on fertile branches and on old trees frequently thick, keeled above, usually falcate, acute or rarely notched at apex, $\frac{3}{4}'$–$1\frac{1}{2}'$ long, often $\frac{1}{8}'$ wide. **Flowers:** male dark red or rose color; female with broad rounded scales, and oblong strongly reflexed obcordate bracts laciniate above the middle and abruptly contracted at apex into short points. **Fruit** oblong, slightly narrowed from near the middle to the ends, rounded or obtuse at apex, 3′–5′ long, puberulous, grayish green, dark purple or bright canary-yellow, with scales much broader than long, gradually and regularly narrowed from the rounded apex, rather more than twice as long as their emarginate or nearly truncate bracts broad at the apex and terminating in short slender tips; **seeds** $\frac{1}{3}'$–$\frac{1}{2}'$ long, acute at base, dark dull brown, with lustrous rose-colored wings widest near the middle and nearly truncate at apex.

A tree, on the California sierras 200°–250° high, with a trunk often 6° in diameter or in the interior of the continent rarely more than 125° tall, with a trunk seldom exceeding 3° in diameter, a narrow spire-like crown of short stout branches clothed with long lateral branches pointing forward and forming great frond-like masses of foliage, and glabrous lustrous comparatively stout branchlets dark orange color during their first season, becoming light grayish green or pale reddish brown, and ultimately gray or grayish brown. **Winter-buds** subglobose, $\frac{1}{8}'$–$\frac{1}{4}'$ thick. **Bark** becoming on old trunks sometimes 5′–6′ thick near the ground and deeply divided into broad rounded ridges broken on the surface into irregularly

shaped plate-like scales. **Wood** very light, soft, coarse-grained and not strong nor durable, pale brown or sometimes nearly white; occasionally manufactured into lumber, in northern California used for packing-cases and butter-tubs.

Distribution. Rocky Mountains of southern Colorado, westward to the mountain ranges of California, extending northward into northern Oregon, and southward over

Fig. 56

the mountains of New Mexico and Arizona into northern Mexico and Lower California (Mt. San Pedro Mártir Mountains); the only Fir-tree in the arid regions of the Great Basin, of southern New Mexico and Arizona, and of the mountain forests of southern California.

Often planted as an ornamental tree in Europe (the California form usually as *A. Lowiana* Murr.) and in the eastern states where it grows more vigorously than other Fir-trees.

6. Abies amabilis Forbes. White Fir.

Leaves deeply grooved, very dark green and lustrous on the upper surface, silvery white on the lower, with broad bands of 6 or 8 rows of stomata between the prominent midribs and incurved margins, on sterile branches obtuse and rounded, or notched or occasionally acute at apex, $\frac{3}{4}'$–$1\frac{1}{4}'$ long, $\frac{1}{16}'$–$\frac{1}{12}'$ wide, often broadest above the middle, erect by a twist at their base, very crowded, those on the upper side of the branch much shorter than those on the lower and usually parallel with and closely appressed against it, on fertile branches acute or acuminate with callous tips, occasionally stomatiferous on the upper surface near the apex, $\frac{1}{2}'$–$\frac{3}{4}'$ long; on vigorous leading shoots acute, with long rigid points, closely appressed or recurved near the middle, about $\frac{3}{4}'$ long and nearly $\frac{1}{8}'$ wide. **Flowers:** male red; female with broad rounded scales and rhombic dark purple lustrous bracts erose above the middle and gradually contracted into broad points. **Fruit** oblong, slightly narrowed to the rounded and often retuse apex, deep rich purple, puberulous, $3\frac{1}{2}'$–$6'$ long, with scales $1'$–$1\frac{1}{8}'$ wide, nearly as long as broad, gradually narrowed from the rounded apex and rather more than twice as long as their reddish rhombic or oblong-obovate bracts terminating in long slender tips; **seeds** light yellow-brown, $\frac{1}{2}'$ long, with oblique pale brown lustrous wings about $\frac{3}{4}'$ long.

A tree, often 250° tall, or at high altitudes and in the north usually not more than 70°–80° tall, with a trunk 4°–6° in diameter, in thick forests often naked for 150°, but in open situations densely clothed to the ground with comparatively short branches sweeping down in graceful curves, and stout branchlets clothed for four or five years with soft fine pubescence, light orange-brown in their first season, becoming dark purple and ultimately reddish brown. **Winter-buds** nearly globose, $\frac{1}{8}'$–$\frac{1}{4}'$ thick, with closely imbricated lustrous purple scales. **Bark** on trees up to 150 years old thin, smooth, pale or silvery white,

becoming near the ground on old trees 1½′–2½′ thick, and irregularly divided into comparatively small plates covered with small closely appressed reddish brown or reddish gray scales. **Wood** light, hard, not strong, close-grained, pale brown, with nearly white sapwood; in Washington occasionally manufactured into lumber used in the interior finish of buildings.

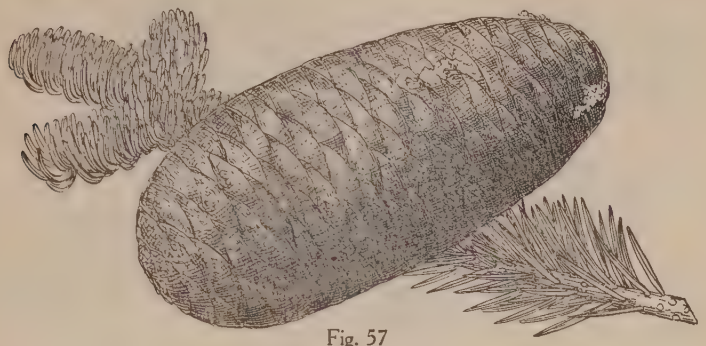

Fig. 57

Distribution. High mountain slopes and benches from southeastern Alaska (Boca de Quadra Inlet and Sandfly Bay), to Vancouver Island and southward along the coast ranges to Saddle Mountain near Astoria, Oregon, and on the Cascade Mountains to the slopes of Old Bailey Mountain, Oregon, ranging from the sea level at the north to elevations of from 3000°–6000° southward; attaining its largest size on the Olympic Mountains of Washington, where it is the most common Fir-tree.

Occasionally cultivated as an ornamental tree in the eastern states and in western Europe, but without developing the beauty which distinguishes this species in its native forests.

7. Abies nobilis Lindl. Red Fir.

Leaves marked on the upper surface with a deep sharply defined groove, rounded and obscurely ribbed on the lower surface, stomatiferous above and below, dark or light blue-green, often very glaucous during their first season, crowded in several rows, those on the lower side of the branch two-ranked by the twisting of their bases, the others crowded, strongly incurved, with the points erect or pointing away from the end of the branch, on young plants and on the lower sterile branches of old trees flat, rounded, usually slightly notched at apex, 1′–1½′ long, about $\frac{1}{18}$′ wide, on fertile branches much thickened and almost equally 4-sided, acuminate, with long rigid callous tips, ½′–¾′ long, on leading shoots flat, gradually narrowed from the base, acuminate, with long rigid points, about 1′ long. **Flowers:** male reddish purple; female often scattered over the upper part of the tree, with broad rounded scales much shorter than their nearly orbicular bracts erose on the margins and contracted above into slender elongated strongly reflexed tips. **Fruit** oblong-cylindric, slightly narrowed but full and rounded at apex, 4′–5′ long, purple or olive-brown, pubescent, with scales about one third wider than long, gradually narrowed from the rounded apex to the base, or full at the sides, rounded and denticulate above the middle and sharply contracted and wedge-shaped below, nearly or entirely covered by their strongly reflexed pale green spatulate bracts full and rounded above, fimbriate on the margins, with broad midribs produced into short broad flattened points; **seeds** ½′ long, pale reddish brown, about as long as their wings, gradually narrowed from below to the nearly truncate slightly rounded apex.

A tree, in old age with a comparatively broad somewhat rounded head, usually 150°–200° and occasionally 250° high, with a trunk 6°–8° in diameter, short rigid branches, short stout remote lateral branches standing out at right angles, and slender reddish brown branch-

lets puberulous for four or five years and generally pointing forward. **Winter-buds** ovoid-oblong, red-brown, about $\frac{1}{8}'$ long. **Bark** becoming on old trunks 1′–2′ thick, bright red-brown, and deeply divided into broad flat ridges irregularly broken by cross fissures and

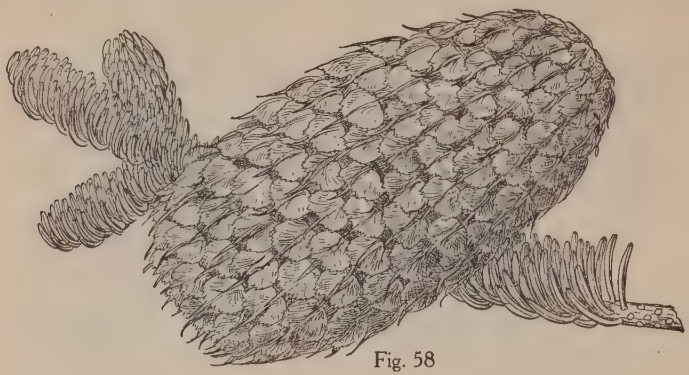

Fig. 58

covered with thick closely appressed scales. **Wood** light, hard, strong, rather close-grained, pale brown streaked with red, with darker colored sapwood; occasionally manufactured into lumber and used under the name of larch for the interior finish of buildings and for packing-cases.

Distribution. Slopes of Mt. Baker in northern Washington and southward to the valley of the Mackenzie River, Oregon, and the Siskiyou Mountains, California, at elevations of from 2000°–5000° above the sea; most abundant and often forming extensive forests on the Cascade Mountains of Washington; less abundant and of smaller size on the eastern and northern slopes of these mountains. In Oregon sometimes called Larch.

Often planted in western and central Europe as an ornamental tree, and in the eastern states hardy in sheltered positions as far north as Massachusetts.

8. Abies magnifica A. Murr. Red Fir.

Leaves almost equally 4-sided, ribbed above and below, with 6–8 rows of stomata on each of the 4 sides, pale and very glaucous during their first season, later becoming blue-green, persistent usually for about ten years; on young plants and lower branches oblanceolate, somewhat flattened, rounded, bluntly pointed, $\frac{3}{4}'$–$1\frac{1}{2}'$ long, $\frac{1}{16}'$ wide, those on the lower side of the branch spreading in 2 nearly horizontal ranks by the twist at their base, on upper, especially on fertile branches, much thickened, with more prominent

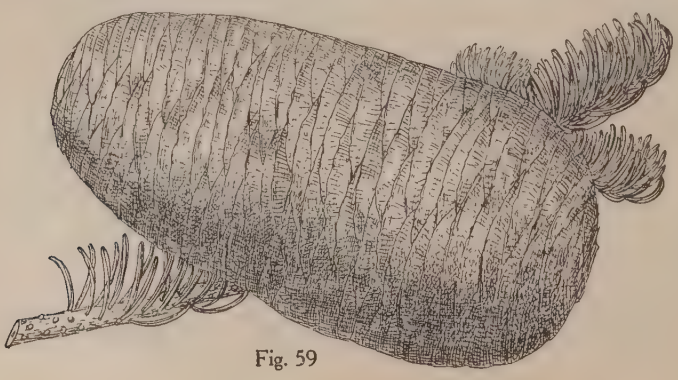

Fig. 59

midribs, acute, with short callous tips, $\frac{1}{3}'$ long on the upper side of the branch to $1\frac{1}{4}'$ long on the lower side, crowded, erect, strongly incurved, completely hiding the upper side of the branch, on leading shoots $\frac{3}{4}'$ long, erect and acuminate, with long rigid points pressed against the stem. **Flowers:** male dark reddish purple; female with rounded scales much shorter than their oblong pale green bracts terminating in elongated slender tips more or less tinged with red. **Fruit** oblong-cylindric, slightly narrowed to the rounded, truncate, or retuse apex, dark purplish brown, puberulous, from 6′–9′ long, with scales often $1\frac{1}{2}'$ wide and about two thirds as wide as long, gradually narrowed to the cordate base, somewhat longer or often two thirds as long as their spatulate acute or acuminate bracts slightly serrulate above the middle and often sharply contracted and then enlarged toward the base; **seeds** dark reddish brown, $\frac{3}{4}'$ long, about as wide as their lustrous rose-colored obovate cuneate wings nearly truncate and often $\frac{3}{4}'$ wide at apex.

A tree, in old age occasionally somewhat round-topped, frequently 200° high, with a trunk 8°–10° in diameter and often naked for half the height of the tree, comparatively short small branches, the upper somewhat ascending, the lower pendulous, and stout light yellow-green branchlets pointing forward, slightly puberulous during their first season, becoming light red-brown and lustrous and ultimately gray or silvery white. **Winter-buds** ovoid, acute, $\frac{1}{4}'$–$\frac{1}{3}'$ long, their bright chestnut-brown scales with prominent midribs produced into short tips. **Bark** becoming 4′–6′ thick near the ground, deeply divided into broad rounded ridges broken by cross fissures and covered by dark red-brown scales. **Wood** light, soft, not strong, comparatively durable, light red-brown, with thick somewhat darker sapwood; largely used for fuel, and in California occasionally manufactured into coarse lumber employed in the construction of cheap buildings and for packing-cases.

Distribution. Cascade Mountains of southern Oregon, southward over the mountain ranges of northern California (summits of the Trinity and Salmon Mountains and on the inner north coast ranges), and along the western slope of the Sierra Nevada to the divide between White and Kern Rivers; common in southern Oregon at elevations between 5000° and 7000° above the sea, forming sometimes nearly pure forests; very abundant on the Sierra Nevada, and the principal tree in the forest belt at elevations between 6000° and 9000°; ascending towards the southern extremity of its range to over 10,000°. Small stunted trees from the neighborhood of Meadow Lake, Sierra County, California, with yellowish cones have been described as var. *xanthocarpa* **Lemm.**

Often planted as an ornamental tree in western and central Europe, and sometimes hardy in the United States as far north as eastern Massachusetts.

A distinct form is

Abies magnifica var. shastensis Lemm. Red Fir.

On the mountains of southern Oregon and at high elevations on those of northern California, and on the southern Sierra Nevada, occurs this form distinguished only by the

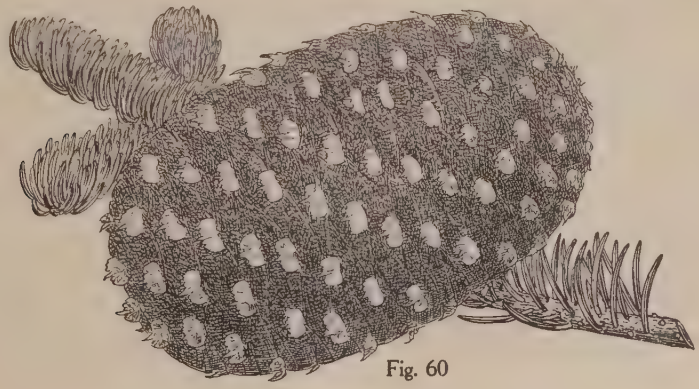

Fig. 60

longer rounded or obtusely pointed (not acute) bright yellow bracts which sometimes cover nearly half their scales.

9. Abies venusta K. Koch. Silver Fir.

Abies bracteata D. Don.

Leaves thin, flat, rigid, linear or linear-lanceolate, gradually or abruptly narrowed toward the base, often falcate, especially on fertile branches, acuminate, with long slender callous tips, dark yellow-green, lustrous and slightly rounded on the upper surface marked below the middle with an obscure groove, silvery white or on old leaves pale on the lower surface, with bands of 8–10 rows of stomata between the broad midrib and the thickened strongly revolute margins, 2-ranked from the conspicuous twist near their base and spreading at nearly right angles to the branch, or pointing forward on upper fertile branches, $1\frac{1}{2}'$–$2\frac{1}{4}'$ long, on leading shoots standing out at almost right angles, rounded on the upper surface, more or less incurved above the middle, $1\frac{1}{2}'$–$1\frac{3}{4}'$ long, about $\frac{1}{8}'$ wide. **Flowers:** male produced in great numbers near the base of the branchlets on branches from the middle of the tree upward, pale yellow; female near the ends of the branchlets of the

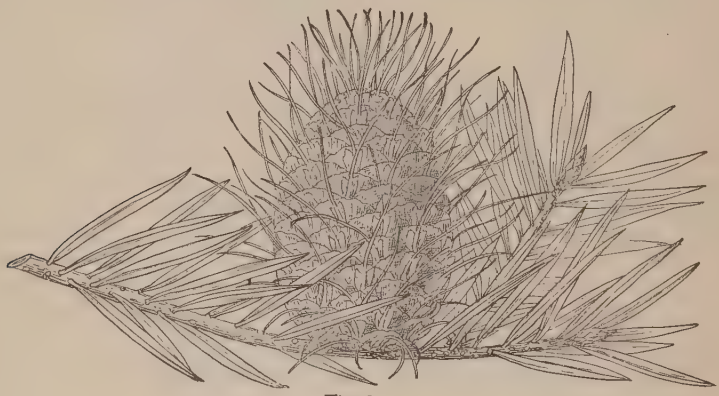

Fig. 61

upper branches only, with oblong scales rounded above and nearly as long as their cuneate obcordate yellow-green bracts ending in slender elongated awns. **Fruit** on stout peduncles sometimes $\frac{1}{2}'$ long, oval or subcylindric, full and rounded at apex, glabrous, pale purple-brown, 3′–4′ long, with thin scales strongly incurved above, obtusely short-pointed at apex, obscurely denticulate on the thin margins, about one third longer than their oblong-obovate obcordate pale yellow-brown bracts terminating in flat rigid tips $1'$–$1\frac{3}{4}'$ long, above the middle of the cone pointing toward its apex and often closely appressed to its sides, below the middle spreading toward its base and frequently much recurved, firmly attached to the cone-scales and deciduous with them from the thick conical sharp-pointed axis of the cone; **seeds** dark red-brown, about $\frac{3}{8}'$ long, and nearly as long as their oblong-obovate pale reddish brown lustrous wings rounded at the apex.

A tree, 100°–150° high, with a trunk sometimes 3° in diameter, comparatively short slender usually pendulous branches furnished with long sinuous rather remote lateral branches sparsely clothed with foliage, forming a broad-based pyramid abruptly narrowed 15°–20° from the top of the tree into a thin spire-like head, and stout glabrous light reddish brown branchlets covered at first with a glaucous bloom. **Winter-buds** ovoid, acute, $\frac{3}{4}'$–$1'$ long, $\frac{1}{4}'$–$\frac{1}{3}'$ thick, with very thin, loosely imbricated, pale chestnut-brown, acute, boat-shaped scales. **Bark** becoming near the base of the tree $\frac{1}{2}'$–$\frac{3}{4}'$ thick, light reddish brown, slightly

and irregularly fissured and broken into thick closely appressed scales. Wood heavy, not hard, coarse-grained, light brown tinged with yellow, with paler sapwood.

Distribution. In the moist bottoms of cañons and on dry rocky summits, usually at elevations of about 3000° above the sea on both slopes of the outer western ridge of the Santa Lucia Mountains, Monterey County, California.

Occasionally and successfully grown as an ornamental tree in the milder parts of Great Britain and in northern Italy; not hardy in the eastern United States.

7. SEQUOIA Endl.

Resinous aromatic trees, with tall massive lobed trunks, thick bark of 2 layers, the outer composed of fibrous scales, the inner thin, close and firm, soft, durable, straight-grained red heartwood, thin nearly white sapwood, short stout horizontal branches, terete lateral branchlets deciduous in the autumn, and scaly or naked buds. Leaves ovate-lanceolate or linear and spreading in 2 ranks especially on young trees and branches, or linear, acute, compressed, keeled on the back and closely appressed or spreading at apex, the two forms appearing sometimes on the same branch or on different branches of the same tree. Flowers minute, solitary, monœcious, appearing in early spring from buds formed the previous autumn, the male terminal in the axils of upper leaves, oblong or ovoid, surrounded by an involucre of numerous imbricated ovate, acute, and apiculate bracts, with numerous spirally disposed filaments dilated into ovoid acute subpeltate denticulate connectives bearing on their inner face 2–5 pendulous globose 2-valved anther-cells; the female terminal, ovoid or oblong, composed of numerous spirally imbricated ovate scales abruptly keeled on the back, the keels produced into short or elongated points closely adnate to the short ovule-bearing scales rounded above and bearing below their upper margin in 2 rows 5–7 ovules at first erect, becoming reversed. Fruit an ovoid or short-oblong pendulous cone maturing during the first or second season, persistent after the escape of the seeds, its scales formed by the enlargement of the united flower and ovuliferous scales, becoming woody, bearing large deciduous resin-glands, gradually enlarged upward and widening at the apex into a narrow thickened oblong disk transversely depressed through the middle and sometimes tipped with a small point. Seeds 5–7 under each scale, oblong-ovoid, compressed; seed-coat membranaceous, produced into broad thin lateral wings; cotyledons 4–6, longer than the inferior radicle.

Sequoia, widely scattered with several species over the northern hemisphere during the cretaceous and tertiary epochs, is now confined to the coast of Oregon and California and the mountains of California, where two species exist.

The name of the genus is formed from Sequoiah, the inventor of the Cherokee alphabet.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Leaves mostly spreading in 2 ranks; cones maturing in one season; buds scaly. 1. **S. sempervirens** (G).

Leaves slightly spreading or appressed; cones maturing in their second season; buds naked. 2. **S. gigantea** (G).

1. Sequoia sempervirens Endl. Redwood.

Leaves of secondary branches and of lower branches of young trees lanceolate, more or less falcate, acute or acuminate and usually tipped with slender rigid points, slightly thickened on the revolute margins, decurrent at the base, spreading in 2 ranks by a half-turn at their base, $\frac{1}{4}'$–$\frac{1}{2}'$ long, about $\frac{1}{8}'$ wide, obscurely keeled and marked above by 2 narrow bands of stomata, glaucous and stomatiferous below on each side of their conspicuous midrib, on leading shoots disposed in many ranks, more or less spreading or appressed, ovate or ovate-oblong, incurved at the rounded apiculate apex, thickened, rounded, and stomatiferous on the lower surface, concave, prominently keeled and covered with stomata

on the upper surface, usually about $\frac{1}{4}'$ long; dying and turning reddish brown at least two years before falling. **Flowers** opening in December or January; male oblong, obtuse; female with about 20 broadly ovate acute scales tipped with elongated and incurved or short points. **Fruit** ripening in October, oblong, $\frac{3}{4}'$–$1'$ long, $\frac{1}{2}'$ broad, its scales gradually enlarged from slender stipes abruptly dilated above into disks penetrated by deep narrow grooves, and usually without tips; **seeds** about $\frac{1}{16}'$ long, light brown, with wings as broad as their body.

Fig. 62

A tree, from 200°–340° high, with a slightly tapering and irregularly lobed trunk usually free of branches for 75°–100°, usually 10°–15°, rarely 28° in diameter at the much buttressed base, slender branches, clothed with branchlets spreading in 2 ranks and forming while the tree is young an open narrow pyramid, on old trees becoming stout and horizontal, and forming a narrow rather compact and very irregular head remarkably small in proportion to the height and size of the trunk, and slender leading branchlets covered at the end of three or four years after the leaves fall with cinnamon-brown scaly bark ; when cut producing from the stump numerous vigorous long-lived shoots. **Buds** with numerous loosely imbricated ovate acute scales persistent on the base of the branchlet. **Bark** 6′–12′ thick, divided into rounded ridges and separated on the surface into long narrow dark brown fibrous scales often broken transversely and in falling disclosing the bright cinnamon-red inner bark. **Wood** light, soft, not strong, close-grained, easily split and worked, very durable in contact with the soil, clear light red; largely manufactured into lumber and used for shingles, fence-posts, railway-ties, wine-butts, and in buildings.

Distribution. Valley of the Chetco River, Oregon, 8 miles north of the California state line, southward near the coast to Monterey County, California; rarely found more than twenty or thirty miles from the coast, or beyond the influence of the ocean fogs, or over 3000° above the sea-level; often forming in northern California pure forests occupying the sides of ravines and the banks of streams; southward growing usually in small groves scattered among other trees; most abundant and of its largest size north of Cape Mendocino.

Often cultivated as an ornamental tree in the temperate countries of Europe, and occasionally in the southeastern United States.

2. Sequoia gigantea Decne. Big Tree.

Sequoia Wellingtonia Seem.

Leaves ovate and acuminate, or lanceolate, rounded and thickened on the lower surface, concave on the upper surface, marked by bands of stomata on both sides of the obscure midrib, rigid, sharp-pointed, decurrent below, spreading or closely appressed above the middle, $\frac{1}{8}'$–$\frac{1}{4}'$ or on leading shoots $\frac{1}{2}'$ long. **Flowers** opening in late winter and early spring; male in great profusion over the whole tree, oblong-ovoid, with ovate acute or acuminate connectives; female with 25–40 pale yellow scales slightly keeled on the back and grad-

ually narrowed into long slender points. **Fruit** maturing in the second year, ovoid-oblong, 2′–3½′ long, 1½′–2¼′ wide, dark reddish brown, the scales gradually thickened upward from the base to the slightly dilated apex, ¾′–1¼′ long, and ¼′–½′ wide, deeply pitted in the middle, often furnished with an elongated reflexed tip and on the upper side near the base with two or three large deciduous resin-glands; **seeds** linear-lanceolate, compressed, ⅛′–¼′ long, light brown, surrounded by laterally united wings broader than the body of the seed, apiculate at the apex, often very unequal.

A tree, at maturity usually about 275° high, with a trunk 20° in diameter near the ground, occasionally becoming 320° tall, with a trunk 35° in diameter, much enlarged and buttressed

Fig. 63

at base, fluted with broad low rounded ridges, in old age naked often for 150° with short thick horizontal branches, slender leading branchlets becoming after the disappearance of the leaves reddish brown more or less tinged with purple and covered with thin close or slightly scaly bark and naked buds. **Bark** 1°–2° thick, divided into rounded lobes 4°–5° wide, corresponding to the lobes of the trunk, separating into loose light cinnamon-red fibrous scales, the outer scales slightly tinged with purple. **Wood** very light, soft, not strong, brittle and coarse-grained, turning dark on exposure; manufactured into lumber and used for fencing, in construction, and for shingles.

Distribution. Western slopes of the Sierra Nevada of California, in an interrupted belt at elevations of 5000°–8400° above the level of the sea, from the middle fork of the American River to the head of Deer Creek just south of latitude 36°; north of King's River in isolated groves, southward forming forests of considerable extent, and best developed on the north fork of the Tule River.

Universally cultivated as an ornamental tree in all the countries of western and southern Europe; and occasionally in the middle eastern United States.

8. TAXODIUM Rich. Bald Cypress.

Resinous trees, with furrowed scaly bark, light brown durable heartwood, thin white sapwood, erect ultimately spreading branches, deciduous usually 2-ranked lateral branchlets, scaly globose buds, and stout horizontal roots often producing erect woody projections (*knees*). Leaves spirally disposed, pale and marked with stomata below on both sides of the obscure midrib, dark green above, linear-lanceolate, spreading in 2 ranks, or scale-like and appressed on lateral branchlets, the two forms appearing on the same or on different branches of the same tree or on separate trees, deciduous. Flowers unisexual, from buds formed the previous year; male in the axils of scale-like bracts in long terminal drooping panicles, with 6–8 stamens opposite in 2 ranks, their filaments abruptly enlarged

into broadly ovate peltate yellow connectives bearing on their inner face in 2 rows 4–9 2-valved pendulous anther-cells; female scattered near the ends of the branches of the previous year, subglobose, composed of numerous ovate spirally arranged long-pointed scales, adnate below to the thickened fleshy ovuliferous scales bearing at their base 2 erect bottle-shaped ovules. Fruit a globose or obovoid short-stalked woody cone maturing the first year and persistent after the escape of the seeds, formed from the enlargement and union of the flower and ovule-bearing scales abruptly dilated from slender stipes into irregularly 4-sided disks often mucronate at maturity, bearing on the inner face, especially on the stipes, large dark glands filled with blood-red fragrant liquid resin. Seeds in pairs under each scale, attached laterally to the stipes, erect, unequally 3-angled; seed-coat light brown and lustrous, thick, coriaceous or corky, produced into 3 thick unequal lateral wings and below into a slender elongated point; cotyledons 4–9, shorter than the superior radicle.

Taxodium, widely distributed through North America and Europe in Miocene and Pliocene times, is now confined to the southern United States and Mexico. Two species are distinguished.

The generic name, from *τάξος* and *εἶδος*, indicates a resemblance of the leaves to those of the Yew-tree.

1. Taxodium distichum Rich. Bald Cypress. Deciduous Cypress.

Leaves on distichously spreading branchlets, apiculate, $\frac{1}{2}'$–$\frac{3}{4}'$ long, about $\frac{1}{12}'$ wide, light bright yellow-green or occasionally silvery white below; or on the form with pendulous

Fig. 64

compressed branchlets long-pointed, keeled and stomatiferous below, concave above more or less spreading at the free apex, about $\frac{1}{2}'$ long; in the autumn turning with the branchlets dull orange-brown before falling. **Flowers:** panicles of staminate flowers 4′–5′ long, $1\frac{1}{2}'$–2′ wide, with slender red-brown stems, obovoid flower-buds nearly $\frac{1}{8}'$ long, pale silvery-gray during winter and purple when the flowers expand in the spring. **Fruit** usually produced in pairs at the end of the branch or irregularly scattered along it for several inches, nearly globose or obovoid, rugose, about 1′ in diameter, the scales generally destitute of tips; **seeds** with wings nearly $\frac{1}{4}'$ long, $\frac{1}{8}'$ wide.

A tree, with a tall lobed gradually tapering trunk, rarely 12° and generally 4°–5° in diameter above the abruptly enlarged strongly buttressed usually hollow base, occasionally 150° tall, in youth pyramidal, with slender branches often becoming elongated and slightly pendulous, in old age spreading out into a broad low rounded crown often 100° across, and slender branchlets light green when they first appear, light red-brown and rather lustrous during their first winter, becoming darker the following year, the lateral branchlets de-

ciduous, 3′–4′ long, spreading at right angles to the branch, or in the form with acicular leaves pendulous or erect and often 6′ long. **Bark** 1′–2′ thick, light cinnamon-red and divided by shallow fissures into broad flat ridges separating on the surface into long thin closely appressed fibrous scales. **Wood** light, soft, not strong, very durable, easily worked, light or dark brown, sometimes nearly black; largely used for construction, railway-ties, posts, fences, and in cooperage.

Distribution. River swamps usually submerged during several months of the year, low wet banks of streams, and the wet depressions of Pine-barrens from southern New Jersey and southern Delaware southward generally near the coast to the Everglade Keys, southern Florida, and through the Gulf-coast region to the valley of Devil River, Texas, through Louisiana to southern Oklahoma, through southern and western Arkansas to southeastern Missouri, and through western and northern Mississippi to Tishomingo County, and in western Tennessee and Kentucky to southern Illinois and southwestern Indiana; most common and of its largest size in the south Atlantic and Gulf states, often covering with nearly pure forests great river swamps. From the coast of North Carolina to southern Florida, southern Alabama and eastern and western Louisiana the form with acicular leaves (*Taxodium distichum* var. *imbricarium*, Croom.) is not rare as a small tree in Pine-barren ponds and swamps.

Taxodium distichum var. *imbricarium* is now usually and rightly considered a distinct species for which the correct name is *Taxodium ascendens* Brong.; the extension of its range into western Louisiana is not supported by specimens.

Often cultivated as an ornamental tree in the northern United States, and in the countries of temperate Europe, especially the var. *imbricarium* (as *Glyptostrobus sinensis* Hort. not Endl.).

9. LIBOCEDRUS Endl.

Tall resinous aromatic trees, with scaly bark, spreading branches, flattened branchlets disposed in one horizontal plane and forming an open 2-ranked spray and often ultimately deciduous, straight-grained durable fragrant wood, and naked buds. Leaves scale-like, in 4 ranks, on leading shoots nearly equally decussate, closely compressed or spreading, dying and becoming woody before falling, on lateral flattened branchlets much compressed, conspicuously keeled, and nearly covering those of the other ranks; on seedling plants linear-lanceolate and spreading. Flowers monœcious, solitary, terminal, the two sexes on different branchlets; male oblong, with 12–16 decussate filaments dilated into broad connectives usually bearing 4 subglobose anther-cells; female oblong, subtended at base by several pairs of leaf-life scales slightly enlarged and persistent under the fruit, composed of 6 acuminate short-pointed scales, those of the upper and middle ranks much larger than those of the lower rank, ovate or oblong, fertile and bearing at the base of a minute accrescent ovuliferous scale 2 erect ovules. Fruit an oblong cone maturing in one season, with subcoriaceous scales marked at the apex by the free thickened mucronulate border of the enlarged flower-scales, those of the lowest pair ovate, thin, reflexed, much shorter than the oblong thicker scales of the second pair widely spreading at maturity; those of the third pair confluent into an erect partition. Seeds in pairs, erect on the base of the scale; seed-coat membranaceous, of 2 layers, produced into thin unequal lateral wings, one narrow, the other broad, oblique, nearly as long as the scale; cotyledons 2, about as long as the superior radicle.

Libocedrus is confined to western North America, western South America, where it is distributed from Chili to Patagonia, New Zealand, New Caledonia, New Guinea, Formosa, and southwestern China. Eight species are distinguished.

Libocedrus, from λιβάς and *Cedrus*, relates to the resinous character of these trees.

1. Libocedrus decurrens Torr. Incense Cedar.

Leaves oblong-obovate, decurrent and closely adnate on the branchlets except at the callous apex, $\frac{1}{8}$′ long on the ultimate lateral branchlets to nearly $\frac{1}{2}$′ long on leading shoots, those of the lateral ranks gradually narrowed and acuminate at apex, keeled and glan-

dular on the back, and nearly covering the flattened obscurely glandular-pitted and abruptly pointed leaves of the inner ranks. **Flowers** appearing in January on the ends of short lateral branchlets of the previous year; male tingeing the tree with gold during the winter and early spring, ovate, nearly $\frac{1}{4}'$ long, with nearly orbicular or broadly ovate connectives, rounded, acute or acuminate at the apex and slightly erose on the margins; female subtended by 2–6 pairs of leaf-like scales, with ovate acute light yellow-green slightly spreading scales. **Fruit** ripening and discharging its seeds in the autumn, oblong, $\frac{3}{4}'$–$1'$ long, pendulous, light red-brown; **seeds** oblong-lanceolate, $\frac{1}{3}'$–$\frac{1}{2}'$ long, semiterete and marked below by a conspicuous pale basal hilum; inner layer of the seed-coat penetrated by elongated resin-chambers, filled with red liquid balsamic resin.

A tree, usually 80°–100° or rarely 150° high, with a tall straight slightly and irregularly lobed trunk tapering from a broad base, 3° or 4° or occasionally 6° or 7° in diameter,

Fig. 65

slender branches erect at the top of the tree, below sweeping downward in bold curves, forming a narrow open feathery crown becoming in old age irregular in outline by the greater development of a few ultimately upright branches forming secondary stems, and stout branchlets somewhat flattened and light yellow-green at first, turning light red-brown during the summer and ultimately brown more or less tinged with purple, the lateral branchlets much flattened, $4'$–$6'$ long, and usually deciduous at the end of the second or third season. **Bark** $\frac{1}{2}'$–$1'$ thick, bright cinnamon-red, and broken into irregular ridges covered with closely appressed plate-like scales. **Wood** light, soft, close-grained very durable in contact with the soil, light reddish brown, with thin nearly white sapwood; often injured by dry rot but largely used for fencing, laths and shingles, the interior finish of buildings, for furniture, and in the construction of flumes.

Distribution. Singly or in small groves from the southeastern slope of Mt. Hood, Oregon, and southward along the Cascade Mountains; on the high mountains of northern California, on the western slopes of the Sierra Nevada, and in Alpine County on their eastern slope, on the Washoe Mountains, western Nevada, in the California coast ranges from the Santa Lucia Mountains, Monterey County to the high mountains in the southern part of the state; on the Sierra del Pimal and the San Pedro Mártir Mountains, Lower California; most abundant and of its largest size on the Sierra Nevada, of central California at elevations of 5000°–7000° above the sea.

Often cultivated as an ornamental tree in western and central Europe, where it grows rapidly and promises to attain a large size; occasionally planted in the New England and middle Atlantic states; hardy in the Arnold Arboretum.

10. THUJA L. Arbor-vitæ.

Resinous aromatic trees, with thin scaly bark, soft durable straight-grained heartwood, thin nearly white sapwood, slender spreading or erect branches, pyramidal heads, flattened lateral pendulous branchlets disposed in one horizontal plane, forming a flat frond-like spray and often finally deciduous, and naked buds. Leaves decussate, scale-like, acute, stomatiferous on the back, on leading shoots appressed or spreading, rounded or slightly keeled on the back, narrowed into long slender points, on lateral branchlets much compressed in the lateral ranks, prominently keeled and nearly covering those of the other ranks; on seedling plants linear-lanceolate, acuminate, spreading or reflexed. Flowers minute, monœcious, from buds formed the previous autumn, terminal, solitary, the two sexes usually on different branchlets; male ovoid, with 4–6 decussate filaments, enlarged into suborbicular peltate connectives bearing on their inner face 2–4 subglobose anther-cells; female oblong, with 8–12 oblong acute scales opposite in pairs, the ovuliferous scales at their base bearing usually 2 erect bottle-shaped ovules. Fruit an ovoid-oblong erect pale cinnamon-brown cone maturing in one season, its scales thin (thick in one species), leathery, oblong, acute, marked near the apex by the thickened free border of the enlarged flower-scales, those of the 2 or 3 middle ranks largest and fertile. Seeds usually 2, erect on the base of the scale, ovoid, acute, compressed, light chestnut-brown; seed-coat membranaceous, produced except in one species into broad lateral wings distinct at the apex; cotyledons 2, longer than the superior radicle.

Thuja is confined to northeastern and northwestern America, to Japan, Korea and northern China. Five species are recognized. Of the exotic species the Chinese *Thuja orientalis*, L., with many varieties produced by cultivation, is frequently planted in the United States, especially in the south and west, for the decoration of gardens, and is distinguished from the other species by the thick umbonate scales of the cone, only the 4 lower scales being fertile, and by the thick rounded dark red-purple seeds without wings.

Thuja is the classical name of some coniferous tree.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Fruit with usually 4 fertile scales.	1. **T. occidentalis** (A).
Fruit with usually 6 fertile scales.	2. **T. plicata.** (B, F, G).

1. Thuja occidentalis L. White Cedar. Arbor-vitæ.

Leaves on leading shoots often nearly $\frac{1}{4}'$ long, long-pointed and usually conspicuously glandular, on lateral branchlets much flattened, rounded and apiculate at apex, without glands or obscurely glandular-pitted, about $\frac{1}{8}'$ long. **Flowers** opening in April and May, liver color. **Fruit** ripening and discharging its seeds in the early autumn, $\frac{1}{3}'$–$\frac{1}{2}'$ long; **seeds** $\frac{1}{8}'$ long, the thin wings as wide as the body.

A tree, 50°–60° high, with a short often lobed and buttressed trunk, occasionally 6° although usually not more than 2°–3° in diameter, often divided into 2 or 3 stout secondary stems, short horizontal branches soon turning upward and forming a narrow compact pyramidal head, light yellow-green branchlets paler on the lower surface than on the upper, changing with the death of the leaves during their second season to light cinnamon-red, growing darker the following year, gradually becoming terete and abruptly enlarged at the base and finally covered with smooth lustrous dark orange-brown bark, and marked by conspicuous scars left by the falling of the short pendulous lateral branchlets. **Bark** $\frac{1}{4}'$–$\frac{1}{3}'$ thick, light red-brown often tinged with orange color and broken by shallow fissures into narrow flat connected ridges separating into elongated more or less persistent scales. **Wood** light, soft, brittle, very coarse-grained, durable, fragrant, pale yellow-brown; largely used in Canada and the northern states for fence-posts, rails, railway-ties, and shingles. Fluid extracts and tinctures made from the young branchlets are sometimes used in medicine.

Distribution. Frequently forming nearly impenetrable forests on swampy ground or

often occupying the rocky banks of streams, from Nova Scotia and New Brunswick, northwestward to the mouth of the Saskatchewan, and southward through eastern Canada to southern New Hampshire, central Massachusetts, New York, central Ohio, northern

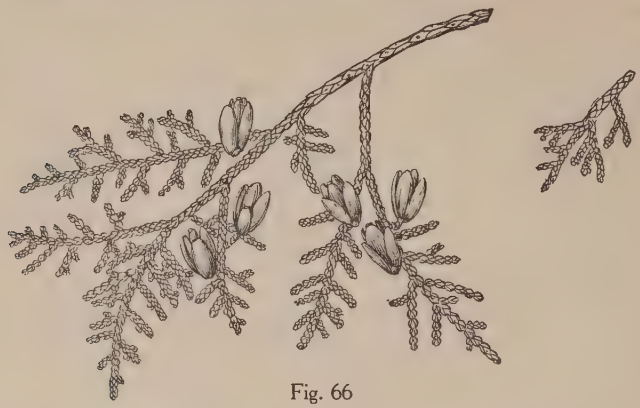

Fig. 66

Indiana and Illinois, and Minnesota; occasionally on the high mountains of Virginia, West Virginia, and northeastern Tennessee, and on the mountains of western Burke County, North Carolina, at an altitude of 3000 feet; very common at the north, less abundant and of smaller size southward.

Often cultivated, with many, often dwarf, forms produced in nurseries, as an ornamental tree and for hedges; and in Europe from the middle of the sixteenth century.

2. Thuja plicata D. Don. Red Cedar. Canoe Cedar.

Leaves on leading shoots ovate, long-pointed, often conspicuously glandular on the back, frequently $\frac{1}{4}'$ long, on lateral branchlets ovate, apiculate, without glands or obscurely glandular-pitted, usually not more than $\frac{1}{8}'$ long, mostly persistent 2–5 years. **Flowers** about $\frac{1}{12}'$ long, dark brown. **Fruit** ripening early in the autumn, clustered near the ends of the branches, much reflexed, $\frac{1}{2}'$ long, with thin leathery scales, conspicuously marked near the apex by the free border of the flower-scale furnished with short stout erect or recurved dark mucros; **seeds** often 3 under each fertile scale, rather shorter than their usually slightly unequal wings about $\frac{1}{4}'$ long.

Fig. 67

A tree, frequently 200° high, with a broad gradually tapering buttressed base sometimes 15° in diameter at the ground and in old age often separating toward the summit into 2 or 3 erect divisions, short horizontal branches, usually pendulous at the ends, forming a dense narrow pyramidal head, and slender much compressed branchlets often slightly zigzag, light bright

yellow-green during their first year, then cinnamon-brown, and after the falling of the leaves, lustrous and dark reddish brown often tinged with purple, the lateral branchlets 5′–6′ long, light green and lustrous on the upper surface, somewhat paler on the lower surface, turning yellow and falling generally at the end of their second season. **Bark** bright cinnamon-red, ½′–¾′ thick, irregularly divided by narrow shallow fissures into broad ridges rounded on the back and broken on the surface into long narrow rather loose plate-like scales. **Wood** light, soft, not strong, brittle, coarse-grained, easily split, dull brown tinged with red; largely used in Washington and Oregon for the interior finish of buildings, doors, sashes, fences, shingles, and in cabinet-making and cooperage. From this tree the Indians of the northwest coast split the planks used in the construction of their lodges, carved the totems which decorate their villages, and hollowed out their great war canoes, and from the fibres of the inner bark made ropes, blankets, and thatch for their cabins.

Distribution. Singly and in small groves on low moist bottom-lands or near the banks of mountain streams, from the sea-level to elevations of 6000° in the interior, from Baranoff Island, Alaska, southward along the coast ranges of British Columbia, western Washington, and Oregon, where it is the most abundant and grows to its largest size, and through the California-coast region to Mendocino County, ranging eastward along many of the interior ranges of British Columbia, northern Washington, Idaho, and Montana to the western slope of the continental divide.

Often cultivated as an ornamental tree in the parks and gardens of western and central Europe where it has grown rapidly and vigorously, and occasionally in the middle and north Atlantic states.

11. CUPRESSUS L. Cypress.

Resinous trees, with bark often separating into long shred-like scales, fragrant durable usually light brown heartwood, pale yellow sapwood, stout erect branches often becoming horizontal in old age, slender 4-angled branchlets, and naked buds. Leaves scale-like, ovate, acute, acuminate, or bluntly pointed at apex, with slender spreading or appressed tips, thickened, rounded, and often glandular on the back, opposite in pairs, becoming brown and woody before falling; on vigorous leading shoots and young plants needle-shaped or linear-lanceolate and spreading. Flowers minute, monœcious, terminal, yellow, the two sexes on separate branchlets; the male oblong, of numerous decussate stamens, with short filaments enlarged into broadly ovate connectives bearing 2–6 globose pendulous anther-cells; female oblong or subglobose, composed of 6–10 thick decussate scales bearing in several rows at the base of the ovuliferous scale numerous erect bottle-shaped ovules. Fruit an erect nearly globose cone maturing in the second year, composed of the much thickened ovule-bearing scales of the flower, abruptly dilated, clavate and flattened at the apex, bearing the remnants of the flower-scales developed into a short central more or less thickened mucro or boss; long-persistent on the branch after the escape of the seeds. Seeds numerous, in several rows, erect, thick, and acutely angled or compressed, with thin lateral wings; seed-coat of 2 layers, the outer thin and membranaceous, the inner thicker and crustaceous; cotyledons 3 or 4, longer than the superior radicle.

Cupressus with ten or twelve species is confined to Pacific North America and Mexico in the New World and to southeastern Europe, southwestern Asia, the Himalayas, and China in the Old World. Of the exotic species *Cupressus sempervirens* L., of southeastern Europe and southwestern Asia, and especially its pyramidal variety, are often planted for ornament in the south Atlantic and Pacific states.

Cupressus is the classical name of the Cypress-tree.

CONSPECTUS OF THE NORTH AMERICAN SPECIES

Leaves dark green.

Leaves eglandular or obscurely glandular on the back.

Leaves obtusely pointed; cones puberulous, 1′–1½′ in diameter; seeds light chestnut-brown. **1. C. macrocarpa** (G).

Leaves acutely pointed; cones $\frac{1}{2}'$–$\frac{2}{3}'$ in diameter; seeds dark brown or black. 2. **C. Goveniana** (G).

Leaves glandular-pitted on the back, acute.
Cones $\frac{2}{3}'$–$1'$ in diameter; seeds brown, often glaucous. 3. **C. Sargentii** (G).
Cones $\frac{1}{2}'$–$1'$ in diameter, often covered with a glaucous bloom; seeds dark chestnut-brown. 4. **C. Macnabiana** (G).

Leaves pale bluish green.
Leaves obtusely pointed, with small gland-pits; bark of the trunk smooth, lustrous, mahogany brown; branches bright red. 5. **C. guadaloupensis** (G).
Leaves acute, eglandular or occasionally obscurely glandular (in var. *glabra* conspicuously glandular); bark of the trunk dark brown, separating into long narrow persistent fibres; branchlets gray. 6. **C. arizonica** (H).

1. Cupressus macrocarpa Gord. Monterey Cypress.

Leaves dark green, bluntly pointed, eglandular, and $\frac{1}{4}'$–$\frac{1}{2}'$ long; deciduous at the end of three or four years. **Flowers** opening late in February or early in March, yellow. **Fruit** clustered on short stout stems subglobose, slightly puberulous, $1'$–$1\frac{1}{2}'$ in diameter, composed of 4 or 6 pairs of scales, with broadly ovoid thickened or occasionally on the upper scales subconical bosses, the scales of the upper and lower pairs being smaller than the others and sterile; **seeds** about 20 under each fertile scale, angled, light chestnut-brown, about $\frac{1}{16}'$ long.

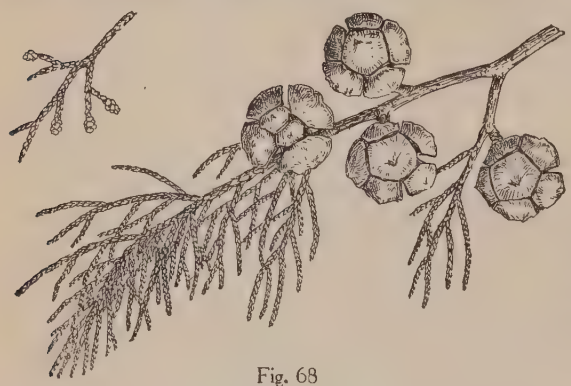

Fig. 68

A tree, often 60°–70° high, with a short trunk 2°–3° or exceptionally 5°–6° in diameter, slender erect branches forming a narrow or broad bushy pyramidal head, becoming stout and spreading in old age into a broad flat-topped crown, and stout branchlets covered when the leaves fall at the end of three or four years with thin light or dark reddish brown bark separating into small papery scales. **Bark** $\frac{3}{4}'$–$1'$ thick and irregularly divided into broad flat connected ridges separating freely into narrow elongated thick persistent scales, dark red-brown on young stems and upper branches, becoming at last almost white on old and exposed trunks. **Wood** heavy, hard and strong, very durable, close-grained.

Distribution. Coast of California south of the Bay of Monterey, occupying an area about two miles long and two hundred yards wide from Cypress Point to the shores of Carmel Bay, with a small grove on Point Lobos, the southern boundary of the bay.

Universally cultivated in the Pacific states from Vancouver Island to Lower California, and often used in hedges and for wind-breaks; occasionally planted in the southeastern states; much planted in western and southern Europe, temperate South America, and in Australia and New Zealand.

2. Cupressus Goveniana Gord.

Cupressus pygmæa Sarg.

Leaves acutely pointed, dark green. **Flowers:** male obscurely 4-angled, with broadly ovate peltate connectives: female with 6–10 ovate pointed scales. **Fruit** usually sessile,

subglobose ¼′–⅞′ in diameter, its scales terminating in small bosses; **seeds** compressed, black, or dark brown, papillose, about ⅛′ long.

A tree rarely 75° high, with a tall trunk up to 2°10′ in diameter, often not more than 25° high, more often a shrub with numerous stems 1°–15° tall, ascending branches, and comparatively stout bright reddish brown branchlets, becoming purple and ultimately dark reddish

Fig. 69

brown; often beginning to produce fertile cones when only 1° or 2° tall. **Bark** bright reddish brown, about ¼′ thick, and divided by shallow fissures into flat ridges separating on the surface into long thread-like scales. **Wood** soft, very coarse-grained, pale reddish brown.

Distribution. California: pine barrens on the western slope of Point Pinos Ridge two miles west of Monterey, and on alkaline soil in a narrow belt beginning about three quarters of a mile from the shore of Mendocino County and extending inland for three or four miles from Ten Mile Run on the north to the Navarro River on the south; arborescent and also of its smallest size only in this northern station.

3. Cupressus Sargentii Jeps. Sargent's Cypress.

Cupressus Goveniana Engelm. not Gord. (*Silva N. Am.* x. 107 t. 527)

Leaves obscurely glandular or without glands, dark green, pungently aromatic, ⅛′–⅛′ long, turning bright red-brown in drying and falling at the end of three or four years; on young plants ⅛′–¼′ long. **Flowers**: male with thin slightly erose connectives: female of 6 or 8 acute slightly spreading scales. **Fruit** often in crowded clusters, short-stalked, subglobose, ½′–1′ in diameter, reddish brown or purple, lustrous, puberulous, its 6 or 8 scales with broadly ovoid generally rounded and flattened and rarely short-obconic bosses; **seeds** brown, lustrous, often glaucous, with an acute margin, ⅛′ long, about 20 under each fertile scale.

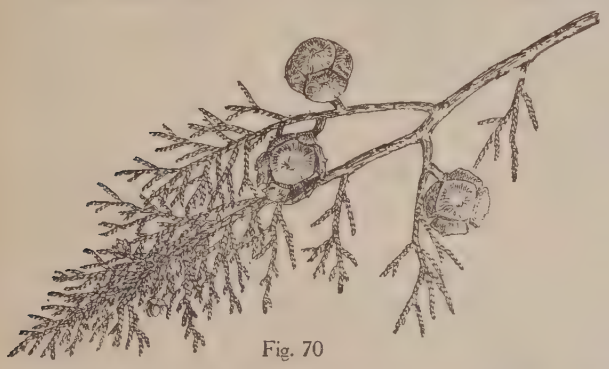

Fig. 70

A tree, shrub, or small bushy tree rarely more than 15° or 16° high, with a short trunk 2° in diameter, slender erect or spreading branches forming a handsome open head, and thin branchlets covered with close smooth bark, at first orange-colored, becoming bright reddish brown, and ultimately purple or dark brown. **Bark** $\frac{1}{4}'$–$\frac{1}{2}'$ thick, dark grayish brown, irregularly divided into narrow ridges covered with thin persistent oblong scales. **Wood** light, soft, not strong, light brown, with thick nearly white sapwood.

Distribution. California: dry mountain slopes usually between altitudes of 1300° and 2300° in few widely isolated stations, Red Mountain, Mendocino County, to Mt. Tamalpais, Marin County; Cedar Mountain, Alameda County; Santa Cruz Mountains, Santa Cruz County; Santa Lucia Mountains, Monterey County; often covering great areas on the hills of Marin County with dense thickets only a few feet high.

Occasionally cultivated as *C. Goveniana* in western and southern Europe as an ornamental tree.

4. Cupressus Macnabiana A. Murr. Cypress.

Cupressus Bakeri Jeps.

Cupressus nevadensis Abrams.

Leaves acute or rounded at apex, rounded and conspicuously glandular on the back, deep green, often slightly glaucous, usually not more than $\frac{1}{16}'$ long. **Flowers** in March and April, male nearly cylindric, obtuse, with broadly ovate rounded connectives: female subglobose, with broadly ovate scales short-pointed and rounded at apex. **Fruit** oblong, subsessile or raised on a slender stalk, $\frac{1}{2}'$–$1'$ long, dark reddish brown more or less covered with a glaucous bloom, slightly puberulous, especially along the margins of the 6 or rarely 8 scales, their prominent bosses thin and recurved on the lower scales, and much thickened, conical, and more or less incurved on the upper scales; **seeds** dark chestnut-brown, usually rather less than $\frac{1}{16}'$ long, with narrow wings.

A tree in Oregon occasionally 80° high with a tall trunk sometimes $3\frac{1}{2}°$ in diameter, southward rarely more than 30° high, with a short trunk 12′–15′ in diameter, slender branches covered with close smooth compact bark, bright purple after the falling of the leaves, soon becoming dark brown; more often a shrub with numerous stems 6°–12° tall forming a broad open irregular head. **Bark** thin, dark reddish brown, broken into brown flat ridges, and separating on the surface into elongated thin slightly attached long-persistent scales. **Wood** light, soft, very close-grained.

Fig. 71

Distribution. Rare and local, usually in small groves; dry ridges of Mount Steve and adjacent mountains up to altitudes of 5300°, Josephine County, southwestern Oregon; California; on lava beds, southeastern Siskiyou and southwestern Mono Counties (*C. Bakeri*); dry hills and low slopes, Mt. Ætna, in central Napa County; through Lake County to Red Mountain on the east side of Ukiah Valley, Mendocino County; in Trinity County between Shasta and Whiskeytown; and on the Sierra Nevada (Red Hill, Piute Mountains near Bodfish) Kern County, at an altitude of 5000° (*C. nevadensis*).

Occasionally cultivated in western and southern Europe as an ornamental tree.

5. Cupressus guadaloupensis S. Wats. Tecate Cypress.

Leaves acute, rounded and minutely glandular-pitted or eglandular on the back, light blue-green, about $\frac{1}{16}'$ long. **Fruit** on stout stems $\frac{1}{4}'$–$\frac{1}{3}'$ in length, subglobose to short-oblong, $\frac{3}{4}'$–$1\frac{1}{4}'$ in diameter, puberulous especially along the margins of the six or eight scales, with prominent flattened or conic acute often incurved bosses; **seeds** about 70 under each scale, short-oblong, nearly square, light chestnut-brown up to $\frac{1}{4}'$ in length, with a narrow wing.

A tree in California sometimes 20°–25° in height, with a short slender or on exposed mountain slopes a trunk occasionally 2° or 3° in diameter, few short spreading or ascending branches forming an open head, and light red-brown lustrous branchlets becoming purplish. Bark smooth, lustrous, without resin or fibres, mahogany brown, the thin scales in falling leaving pale marks.

Fig. 72

Distribution. San Diego County, California, rare and local; valley of the San Luis Rey River between Valley Centre and Pala; at altitudes between 1100° and 4000° in the gulches and on the summit of Mt. Tecate on the border between the United States and Lower California; on a mountain below Descanso and Pine Valley; in Cedar Cañon between El-nido and Dulzura; in Lower California on San Pedro Mártir Mountain and Guadaloupe Island. The insular form is a larger tree often with larger gland-pits on the leaves, and now often cultivated in California, western Europe, and in other countries with temperate climates.

6. Cupressus arizonica Greene. Cypress.

Leaves obtusely pointed, rounded, eglandular or rarely glandular-pitted on the back, pale green, $\frac{1}{16}'$ long, dying and turning red-brown in their second season, generally falling four years later. **Flowers:** male oblong, obtuse, their 6 or 8 stamens with broadly ovate acute yellow connectives slightly erose on the margins: female not seen. **Fruit** on stout pedicels $\frac{1}{4}'$–$\frac{1}{2}'$ in length, subglobose, rather longer than broad, wrinkled, dark red-brown and covered with a glaucous bloom, the six or eight scales with stout flattened incurved prominent bosses; **seeds** oblong to nearly triangular, dark red-brown, $\frac{1}{16}'$–$\frac{1}{8}'$ long with a thin narrow wing.

A conical tree 40°–70° high with a trunk 2°–4° in diameter, and stout spreading branches covered with bark separating into thin plates, leaving a smooth red surface, and branchlets

dark gray after the leaves fall. **Bark** on young trunks separating into large irregular curling thin scales, on old trees becoming dark red-brown and fibrous.

Distribution. Mountains above Clifton, Greenlee County, eastern Arizona; on the

Fig. 73

San Francisco Mountains, Socorro County, and San Luis Mountains, Grant County, western New Mexico; and in Chihuahua. Passing into

Cupressus arizonica var. bonita Lemm.

Cupressus glabra Sudw.

Differing from the type in the prominent oblong or circular glandular depressions on the backs of the leaves.

A tree 30°–70° high, with a trunk 18′–24′ or rarely 5° in diameter, erect branches forming a rather compact conical head. **Bark** of the trunk and large branches thin; smooth, dark

Fig. 74

reddish brown, separating into small curled scale-like plates, becoming on old trees dark gray and fibrous. **Wood** heavy, hard, pale straw color with lighter-colored sapwood,

durable in contact with the ground, somewhat used for fence-posts, corral-piles, mine-timbers and in log cabins.

Distribution. Gravelly slopes and moist gulches often in groups of considerable size at altitudes between 4000° and 7000°, Arizona; near Camp Verde, Tonto Basin; Natural Bridge, Payson, etc.; on the Chiracahua Mountains (*J. W. Toumey*, July, 1894); on the Santa Rita and Santa Catalina Mountains, and in Oak Creek Cañon twenty miles south of Flagstaff (*P. Lowell*, June, 1911).

Now often cultivated in western Europe as *C. arizonica*.

12. CHAMÆCYPARIS.

Tall resinous pyramidal trees, with thin scaly or deeply furrowed bark, nodding leading shoots, spreading branches, flattened, often deciduous or ultimately terete branchlets 2-ranked in one horizontal plane, pale fragrant durable heartwood, thin nearly white sap-wood, and naked buds. Leaves scale-like, ovate, acuminate, with slender spreading or appressed tips, opposite in pairs, becoming brown and woody before falling, on vigorous sterile branches and young plants needle-shaped or linear-lanceolate and spreading. Flowers minute, monœcious, terminal, the two sexes on separate branchlets; the male oblong, of numerous decussate stamens, with short filaments enlarged into ovate connectives decreasing in size from below upward and bearing usually 2 pendulous globose anther-cells; the female subglobose, composed of usually 6 decussate peltate scales bearing at the base of the ovuliferous scales 2–5 erect bottle-shaped ovules. Fruit an erect globose cone maturing at the end of the first season, surrounded at the base by the sterile lower scales of the flowers, and formed by the enlargement of the ovule-bearing scales, abruptly dilated, club-shaped and flattened at the apex, bearing the remnants of the flower-scales as short prominent points or knobs; persistent on the branches after the escape of the seeds. Seeds 1–5, erect on the slender stalk-like base of the scale, subcylindric and slightly compressed; seed-coat of 2 layers, the outer thin and membranaceous, the inner thicker and crustaceous, produced into broad lateral wings; cotyledons 2, longer than the superior radicle.

Chamæcyparis is confined to the Atlantic and Pacific coast regions of North America, and to Japan and Formosa. Six species are distinguished. Of exotic species the Japanese Retinosporas, *Chamæcyparis obtusa* Endl., and *Chamæcyparis pisifera* Endl., with their numerous abnormal forms are familiar garden plants in all temperate regions.

Chamæcyparis is from χαμαί, on the ground, and κυπάρισσος, cypress.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Bark thin, divided into flat ridges;
- Branchlets slender, often compressed; leaves dull blue-green, usually conspicuously glandular. 1. **C. thyoides** (A, C).
- Branchlets stout, slightly flattened or terete; leaves dark blue-green, usually without glands. 2. **C. nootkatensis** (B, G).

Bark thick, divided into broad rounded ridges; branchlets slender, compressed; leaves bright green, conspicuously glandular. 3. **C. Lawsoniana** (G).

1. Chamæcyparis thyoides B. S. P. White Cedar.

Cupressus thyoides L.

Leaves closely appressed, or spreading at the apex especially on vigorous leading shoots, keeled and glandular or conspicuously glandular-punctate on the back, dark dull blue-green or pale below, at the north becoming russet-brown during the winter, $\frac{1}{16}'$–$\frac{1}{8}'$ long, dying during the second season and then persistent for many years. **Flowers:** male composed of 5 or 6 pairs of stamens, with ovate connectives rounded at apex, dark brown below the middle, nearly black toward the apex: female subglobose, with ovate acute

spreading pale liver-colored scales and black ovules. **Fruit** $\frac{1}{4}'$ in diameter, sessile on a short leafy branch, light green, covered with a glaucous bloom when fully grown, later bluish purple and very glaucous, finally becoming dark red-brown, its scales terminating in ovate acute, often reflexed bosses; **seeds** 1 or 2 under each fertile scale, ovoid, acute, full and rounded at the base, slightly compressed, gray-brown, about $\frac{1}{8}'$ long, with wings as broad as the body of the seed and dark red-brown.

A tree, 70°–80° high, with a tall trunk usually about 2 and occasionally 3°–4° in diameter, or northward much smaller, slender horizontal branches forming a narrow spire-like head, and 2-ranked compressed branchlets disposed in an open fan-shaped more or less de-

Fig. 75

ciduous spray, the persistent branchlets gradually becoming terete, light green tinged with red, light reddish brown during their first winter, and then dark brown, their thin close bark separating slightly at the end of three or four years into small papery scales. **Bark** $\frac{3}{4}'$–$1'$ thick, light reddish brown, and divided irregularly into narrow flat connected ridges often spirally twisted round the stem, separating on the surface into elongated loose or closely appressed plate-like scales. **Wood** light, soft, not strong, close-grained, slightly fragrant, light brown tinged with red; largely used in boat-building and cooperage, for woodenware, shingles, the interior finish of houses, fence-posts, and railway-ties.

Distribution. Cold swamps usually immersed during several months of the year, often forming dense pure forests; near Concord, New Hampshire, southern Maine, southward near the coast to northern Florida, and westward to southeastern Mississippi; most abundant south of Massachusetts Bay; comparatively rare east of Boston and west of Mobile Bay.

Occasionally planted as an ornamental tree in the eastern states and in the countries of temperate Europe.

2. Chamæcyparis nootkatensis Sudw. Yellow Cypress. Sitka Cypress.

Cupressus nootkatensis Lamb.

Leaves rounded, eglandular or glandular-pitted on the back, dark blue-green, closely appressed, about $\frac{1}{8}'$ long, on vigorous leading branchlets somewhat spreading and often $\frac{1}{4}'$ long, with more elongated and sharper points, beginning to die at the end of their second year and usually falling during the third season. **Flowers:** male on lateral branchlets of the previous year, composed of 4 or 5 pairs of stamens, with ovate rounded slightly erose light yellow connectives: female clustered near the ends of upper branchlets, dark liver color, the fertile scales each bearing 2–4 ovules. **Fruit** ripening in September and October,

nearly $\frac{1}{2}'$ in diameter, dark red-brown, with usually 4 or 6 scales tipped with prominent erect pointed bosses and frequently covered with conspicuous resin-glands; seeds 2–4 under each scale, ovoid, acute, slightly flattened, about $\frac{1}{4}'$ long, dark red-brown, with thin light red-brown wings often nearly twice as wide as the body of the seed.

Fig. 76

A tree, frequently 120° high, with a tall trunk 5°–6° in diameter, horizontal branches forming a narrow pyramidal head, stout distichous somewhat flattened or terete light yellow branchlets often tinged with red at first, dark or often bright red-brown during their third season, ultimately paler and covered with close thin smooth bark. **Bark** $\frac{1}{2}'$–$\frac{3}{4}'$ thick, light gray tinged with brown, irregularly fissured, and separated on the surface into large thin loose scales. **Wood** hard, rather brittle, very close-grained, exceedingly durable, bright clear yellow, with very thin nearly white sapwood; fragrant with an agreeable resinous odor; used in boat and shipbuilding, the interior finish of houses, and the manufacture of furniture.

Distribution. Islands of Prince William Sound, Alaska, and southward over the coast mountains of Alaska and British Columbia, and along the Cascade Mountains of Washington and Oregon to the northeastern slopes of Mt. Jefferson, extending eastward to the headwaters of the Yakima River on the eastern slope of the range; on Whiskey Peak of the Siskiyou Mountains in the southeastern corner of Josephine County, Oregon and about two miles from the California line; most abundant and of its largest size near the coast of Alaska and northern British Columbia, ranging from the sea-level up to altitudes of 3000°; at high elevations on the Cascade Mountains sometimes a low shrub.

Occasionally cultivated, with its several abnormal forms, as an ornamental tree in the middle Atlantic states and in California, and commonly in the countries of western and central Europe.

3. Chamæcyparis Lawsoniana Parl. Port Orford Cedar. Lawson Cypress.

Cupressus Lawsoniana A. Murr.

Leaves bright green or pale below, conspicuously glandular on the back, usually not more than $\frac{1}{16}'$ long on lateral branchlets, on leading shoots often spreading at the apex, $\frac{1}{8}'$ to nearly $\frac{1}{4}'$ long, usually dying, turning bright red-brown and falling during their third year. **Flowers:** male with bright red connectives bearing usually 2 pollen-sacs: female with dark ovate acute spreading scales, each bearing 2–4 ovules. **Fruit** clustered on the upper lateral branchlets and produced in great profusion, ripening in September and October, about $\frac{1}{3}'$ in diameter, green and glaucous when full grown, red-brown and often covered with a bloom at maturity, its scales with thin broadly ovate acute reflexed bosses; **seeds** 2–4 under each fertile scale, ovoid, acute, slightly compressed, $\frac{1}{8}'$ long, light chestnut-brown, with broad thin wings.

A tree, often 200° high, with a tall trunk frequently 12° in diameter above its abruptly enlarged base, a spire-like head of small horizontal or pendulous branches clothed with

remote flat spray frequently 6′–8′ long. **Bark** often 10′ thick at the base of old trees and 3′–4′ thick on smaller stems, dark reddish brown, with 2 distinct layers, the inner $\frac{1}{8}$′–$\frac{1}{4}$′ thick, darker, more compact, and firmer than the outer, divided into great broad-based rounded ridges separated on the surface into small thick closely appressed scales. **Wood** light, hard, strong, very close-grained, abounding in fragrant resin, durable, easily worked,

Fig. 77

light yellow, or almost white, with hardly distinguishable sapwood; largely manufactured into lumber used for the interior finish and flooring of buildings, railway-ties, fence-posts, and boat and shipbuilding, and on the Pacific coast almost exclusively for matches. The resin is a powerful diuretic.

Distribution. Usually scattered in small groves from the shores of Coos Bay, southwestern Oregon, south to the mouth of the Klamath River, California, ranging inland usually for about thirty miles; near Waldorf, in Josephine County, Oregon, on the slopes of the Siskiyou Mountains, and on the southern flanks of Mt. Shasta, California; most abundant north of Rogue River on the Oregon coast and attaining its largest size on the western slopes of the Coast Range foothills, forming between Point Gregory and the mouth of the Coquille River a nearly continuous forest belt twenty miles long.

Often cultivated with the innumerable forms originated in nurseries, in the middle Atlantic states and California, in all the temperate countries of Europe, and in New Zealand.

13. JUNIPERUS L. Juniper.

Pungent aromatic trees or shrubs, with usually thin shreddy bark, soft close-grained durable wood, slender branches, and scaly or naked buds. Leaves sessile, in whorls of 3, persistent for many years, convex on the lower side, concave and stomatiferous above, linear-subulate, sharp-pointed, without glands (*Oxycedrus*); or scale-like, ovate, opposite in pairs or ternate, closely imbricated, appressed and adnate to the branch, glandular or eglandular on the back, becoming brown and woody on the branch, but on young plants and vigorous shoots often free and awl-shaped (*Sabina*). Flowers minute, dicœcious, axillary or terminal on short axillary branches from buds formed the previous autumn on branches of the year; the male solitary, oblong-ovoid, with numerous stamens decussate or in 3's, their filaments enlarged into ovate or peltate yellow scale-like connectives bearing near the base 2–6 globose pollen-sacs; the female ovoid, surrounded at the base by many minute scale-like bracts persistent and unchanged under the fruit, composed of 2–6 opposite or ternate pointed scales alternate with or bearing on their inner face at the base on a minute ovuliferous scale 1 or 2 ovules. Fruit a berry-like succulent fleshy blue, blue-

black, or red strobile formed by the coalition of the flower-scales, inclosed in a membranaceous skin covered with a glaucous bloom, ripening during the first, second, or rarely during the third season, smooth or marked by the ends of the flower-scales, or by the pointed tips of the ovules, closed, or open at the top and exposing the apex of the seeds. Seeds 1–12, ovoid, acute or obtuse, terete or variously angled, often longitudinally grooved by depressions caused by the pressure of resin-cells in the flesh of the fruit, smooth or roughened and tuberculate, chestnut-brown, marked below by the large conspicuous usually 2-lobed hilum; seed-coat of 2 layers, the outer thick and bony, the inner thin, membranaceous or crustaceous; cotyledons 2, or 4–6, about as long as the superior radicle.

Juniperus is widely scattered over the northern hemisphere from the Arctic Circle to the highlands of Mexico, Lower California, and the West Indies in the New World, and to the Azores and Canary Islands, northern Africa, Abyssinia, the mountains of east tropical Africa, Sikkim, central China, Formosa, Japan and the Bonin Islands in the Old World. About thirty-five species are now distinguished. Of the exotic species cultivated in the United States the most common are European forms of *Juniperus communis* L. with fastigiate branches, and dwarf forms of the European *Juniperus Sabina* L., and of *Juniperus chinensis* L.

Juniperus is the classical name of the Juniper.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Flowers axillary; stamens decussate; ovules 3, alternate with the scales of the flower, their tips persistent on the fruit; seeds usually 3; leaves ternate, linear-lanceolate, prickle-pointed, jointed at the base, eglandular, dark yellow-green, channeled, stomatose, and glaucous above; fruit maturing in the third year, subglobose, bright blue, covered with a glaucous bloom; buds scaly (*Oxycedrus*). 1. **J. communis.**

Flowers terminal on short axiliary branchlets; stamens decussate or in 3's; ovules in the axils of small fleshy scales often enlarged and conspicuous on the fruit; seeds 1–12; leaves ternate or opposite, mostly scale-like, crowded, generally closely appressed, free and awl-shaped on vigorous shoots and young plants; buds naked (*Sabina.*)

Fruit red or reddish brown.

Bark of the trunk separating into long thin persistent scales; fruit maturing in one season.

Leaves closely appressed to the branchlet, obtusely pointed.

Leaves conspicuously glandular-pitted, ternate or opposite; fruit red, subglobose, $\frac{1}{4}'$ in diameter. 2. **J. Pinchotii** (C, H).

Leaves eglandular or slightly glandular; fruit reddish brown.

Leaves ternate, rarely opposite; fruit short-oblong, $\frac{1}{4}'$–$\frac{1}{2}'$ in diameter. 3. **J. californica** (G).

Leaves opposite, rarely ternate; fruit subglobose, $\frac{1}{8}'$–$\frac{1}{4}'$, in one form $\frac{3}{4}'$ in diameter. 4. **J. utahensis** (F, G).

Leaves not closely appressed, spreading at the apex, long-pointed, glandular or eglandular; fruit subglobose, $\frac{1}{3}'$–$\frac{1}{2}'$ in diameter. 5. **J. flaccida** (L).

Bark of the trunk divided into thick nearly square plates; leaves eglandular or occasionally glandular-pitted; fruit subglobose to short-oblong, $\frac{1}{2}'$ in diameter, ripening at the end of its second season. 6. **C. pachyphlæa** (H).

Fruit blue or blue-black, with resinous juicy flesh, subglobose to short-oblong, $\frac{1}{12}'$–$\frac{1}{3}'$ in diameter; seeds, 1–4; cotyledons 2.

Leaves denticulately fringed, opposite or ternate; fruit maturing in one season.

Branchlets about $\frac{1}{12}'$ in diameter; leaves acute, conspicuously glandular; fruit short-oblong, $\frac{1}{4}'$–$\frac{1}{3}'$ in diameter; seeds 2 or 3. 7. **J. occidentalis** (B. G).

Branchlets not more than $\frac{1}{24}'$ in diameter; leaves usually ternate; fruit short-oblong.

Seeds 1 or rarely 2, pale chestnut-brown, obtuse, prominently ridged; leaves acute or acuminate, usually glandular. 8. **J. monosperma** (F).

Seeds 1 or 2, dark chestnut-brown, acute, obscurely ridged; leaves obtusely pointed, often eglandular. **9. J. mexicana** (C).

Leaves naked on the margins, mostly opposite, glandular or eglandular; fruit subglobose.

Fruit ripening at the end of the first season.

Fruit $\frac{1}{4}'$–$\frac{1}{3}'$ in diameter; seeds 1 or 2, rarely 3 or 4; leaves acute or acuminate; branches spreading or erect. **10. J. virginiana** (A, C).

Fruit $\frac{1}{12}'$–$\frac{1}{8}'$ in diameter; seeds 1 or 2; leaves acute; branches usually pendulous. **11. J. lucayana** (C).

Fruit ripening at the end of the second season, $\frac{1}{4}'$–$\frac{1}{3}'$ in diameter; seeds 1 or 2; leaves acute or acuminate. **12. J. scopulorum** (B, F).

1. Juniperus communis L. Juniper.

Leaves spreading nearly at right angles to the branchlets, $\frac{1}{3}'$–$\frac{1}{2}'$ long, about $\frac{1}{32}'$ wide, turning during winter a deep rich bronze color on the lower surface, persistent for many years. **Flowers**: male composed of 5 or 6 whorls each of 3 stamens, with broadly ovate acute and short-pointed connectives, bearing at the very base 3 or 4 globose anther-cells; female

Fig. 78

surrounded by 5 or 6 whorls of ternate leaf-like scales, composed of 3 slightly spreading ovules abruptly enlarged and open at the apex, with 3 minute obtuse fleshy scales below and alternate with them. **Fruit** maturing in the third season, subglobose or short-oblong, about $\frac{1}{4}'$ in diameter, with soft mealy resinous sweet flesh and 1–3 seeds; often persistent on the branches one or two years after ripening; **seeds** ovoid, acute, irregularly angled or flattened, deeply penetrated by numerous prominent thin-walled resin-glands, about $\frac{1}{8}'$ long, the outer coat thick and bony, the inner membranaceous.

In America only occasionally tree-like and 10°–20° tall, with a short eccentric irregularly lobed trunk rarely a foot in diameter, erect branches forming an irregular open head, slender branchlets, smooth, lustrous, and conspicuously 3-angled between the short nodes during their first and second years, light yellow tinged with red, gradually growing darker, their dark red-brown bark separating in the third season into small thin scales, and ovoid acute buds about $\frac{1}{8}'$ long and loosely covered with scale-like leaves; more often a shrub, with many short slender stems prostrate at the base and turning upward and forming a broad mass sometimes 20° across and 3° or 4° high (var. *depressa* Pursh.); at high elevations and in the extreme north prostrate, with long decumbent stems and shorter and more crowded leaves (var. *montana* Ait.) passing into the var. *Jackii* Rehdr. with long trailing branches and broader incurved leaves. **Bark** about $\frac{1}{16}'$ thick, dark reddish brown, sepa-

rating irregularly into many loose papery persistent scales. **Wood** hard, close-grained, very durable in contact with the soil, light brown, with pale sapwood. In northern Europe the sweet aromatic fruit of this tree is used in large quantities to impart its peculiar flavor to gin; occasionally employed in medicine.

Distribution. Occasionally arborescent in New England, eastern Pennsylvania, and on the high mountains of North Carolina; the var. *depressa*, common in poor rocky soil, Newfoundland to southern New England, and to the shores of the Great Lakes and northwestward; the var. *montana* from the coast of Greenland to northern New England, on the high Appalachian Mountains, North Carolina, and to northern Nebraska, along the Rocky Mountains from Alberta to western Texas, and on the Pacific coast from Alaska, southward along mountain ranges to the high Sierras of central California, extending eastward to the mountains of eastern Washington and Oregon, and on the high peaks of northern Arizona up to altitudes of 10,000°–11,500° (*P. Lowell*); the var. *Jackii* on the coast mountains from northern California to Vancouver Island; in the Old World widely distributed in many forms through all the northern hemisphere from arctic Asia and Europe to Japan, the Himalayas and the mountains of the Mediterranean Basin.

Often planted, especially in several of its pyramidal and dwarf forms, in the eastern United States and in the countries of western, central, and northern Europe.

2. Juniperus Pinchotii Sudw.

Leaves ternate, obtusely pointed, rounded and glandular-pitted on the back, $\frac{1}{16}'$ long, dark yellow-green, turning light red-brown before falling; on vigorous shoots and seedling

Fig. 79

plants linear-lanceolate, thin, acuminate, eglandular, $\frac{1}{4}'$–$\frac{1}{3}'$ in length. **Fruit** ripening in one season, subglobose, bright red, $\frac{1}{4}'$ in diameter, with a thin skin and thick dry mealy resinous flesh and 1 seed; **seed** ovoid, bluntly pointed, deeply grooved, irregularly marked by the usually two-lobed hilum, $\frac{1}{8}'$–$\frac{1}{4}'$ long and 2 cotyledons.

A tree rarely 20 feet high, with a trunk 1 foot in diameter, stout wide-spreading branches forming an open irregular head and thick branchlets covered with dark gray-brown scaly bark, their ultimate divisions about $\frac{1}{12}'$ in diameter; more often a shrub with several stems 1° to 12° tall. **Bark** thin, light brown, separating into long narrow persistent scales.

Distribution. Dry rocky slopes and the rocky sides of cañons, Panhandle of western

Texas (Armstrong, Potter and Hartley Counties), and in Hardaman, Garza, Tom Green, Kemble, Valverde and Menard Counties; on Comanche Peak near Granbury, Hood County, Texas; in central and on the mountains of southern Arizona.

3. Juniperus californica Carr. Desert White Cedar. Sweet-berried Cedar.

Leaves usually in 3's, closely appressed, thickened, slightly keeled and conspicuously glandular-pitted on the back, pointed at apex, cartilaginously fringed on the margins, light yellow-green, about $\frac{1}{8}'$ long, dying and turning brown on the branch at the end of two or three years; on vigorous shoots linear-lanceolate, rigid, sharp-pointed, $\frac{1}{4}'$–$\frac{1}{2}'$ long, whitish on the upper surface. **Flowers** from January to March; male of 18–20 stamens, disposed in 3's, with rhomboidal short-pointed connectives; scales of the female flower usually 6, ovate, acute, spreading, obliterated or minute on the fruit. **Fruit** short-oblong or ovoid, $\frac{1}{2}'$–$\frac{3}{4}'$ long, reddish brown, with a membranaceous loose skin covered with a thick glaucous bloom, thick fibrous dry sweet flesh, and 1 or 2 seeds; **seeds** ovoid, obtusely pointed, irregularly lobed and angled, and 4–6 cotyledons.

Fig. 80

A conical tree, occasionally 40° high, with a straight, large-lobed unsymmetrical trunk 1°–2° in diameter; more often shrubby, with many stout irregular usually contorted stems forming a broad open head. **Bark** thin and divided into long loose plate-like scales ashy gray on the outer surface and persistent for many years. **Wood** soft, close-grained, durable in contact with the soil, light brown slightly tinged with red, with thin nearly white sapwood; used for fencing and fuel. The fruit is eaten by Indians fresh or ground into flour.

Distribution. Dry mountain slopes and hills at altitudes between 400° and 4000°, from Moraga Pass and Mt. Diabolo, Contra Costa County, California, southward on the coast ranges, spreading inland to their union with the Sierra Nevada, and northward at low altitudes along the western slopes of the Sierras to Kern and Mariposa Counties; on the desert slopes of the Tehachapi Mountains, the northern foothills of the San Bernardino Mountains, on the western slopes of the San Jacinto and Cayamaca Ranges, and southward in Lower California to Agua Dulce; arborescent and probably of its largest size on the Mohave Desert.

4. Juniperus utahensis Lemm. Juniper.

Leaves opposite or in 3's, rounded, usually glandular, acute or often acuminate, light yellow-green, rather less than $\frac{1}{8}'$ long, persistent for many years. **Flowers:** male with 18–24 opposite or tenate stamens, their connectives rhomboidal; scales of the female flower acute, spreading, often in pairs. **Fruit** ripening during the autumn of the second season, subglobose or short-oblong, marked by the more or less prominent tips of the flower-scales, reddish brown, with a thick firm skin covered with a glaucous bloom and closely in-

vesting the thin dry sweet flesh, $\frac{1}{4}'$–$\frac{1}{3}'$ long, with 1 or rarely 2 seeds; seeds ovoid, acute, obtusely angled, marked to the middle by the hilum, with a hard bony shell, and 4–6 cotyledons.

A bushy tree, rarely exceeding 20° in height, with a short usually eccentric trunk sometimes 2° in diameter, generally divided near the ground by irregular deep fissures into broad rounded ridges, many erect contorted branches forming a broad open head, slender light yellow-green branchlets covered after the falling of the leaves with thin light red-brown scaly bark; more often with numerous stems spreading from the ground and frequently not more than 8°–10° high. Bark about $\frac{1}{4}'$ thick, ashy gray or sometimes nearly

Fig. 81

white, and broken into long thin persistent scales. Wood light brown, slightly fragrant, with thick nearly white sapwood; largely used locally for fuel and fencing. The fruit is eaten by Indians fresh, or ground and baked into cakes.

Distribution. Southwestern Wyoming (*J. Knightii* A. Nels.), southwestern Idaho (Pocatello, Bannock County), western Colorado, eastern Utah, and western New Mexico to northern Arizona and southeastern California at altitudes from 5000° to 8000°; the most abundant and generally distributed tree of the Great Basin, forming in the valleys open forests of stunted trees and shrubs, and on arid slopes more numerous and of larger size in dense nearly pure forests.

A variety (var. *megalocarpa* Sarg.) occurs in eastern New Mexico and northern Arizona, with fruit sometimes $\frac{3}{4}'$ in diameter. A tree often 40° high with a single erect stem sometimes 3° in diameter.

5. Juniperus flaccida Schlecht. Juniper.

Leaves opposite, acuminate and long-pointed, spreading at the apex, glandular or eglandular on the back, light yellow-green, about $\frac{1}{5}'$ long, turning cinnamon-red and dying on the branch; on vigorous young shoots ovate-lanceolate, sometimes $\frac{1}{2}'$ long, with elongated rigid callous tips. Flowers: male slender, composed of 16–20 stamens, with ovate pointed connectives prominently keeled on the back; female with acute or acuminate spreading scales. Fruit subglobose, dull red-brown, more or less covered with a glaucous bloom, $\frac{1}{3}'$–$\frac{1}{2}'$ in diameter, with a close firm skin and thick resinous flesh; seeds 4–12, pointed at apex, slightly ridged, often abortive and distorted, $\frac{1}{8}'$–$\frac{1}{4}'$ long, with 2 cotyledons.

A tree, occasionally 30° high, with gracefully spreading branches and long slender drooping branchlets, covered after the leaves fall with thin bright cinnamon-brown bark separat-

ing into thin loose papery scales; often a shrub. **Bark** about $\frac{1}{2}'$ thick, reddish brown, separating into long narrow loosely attached scales.

Fig. 82

Distribution. In the United States only on the slopes of the Chisos Mountains, in Brewster County, southern Texas; common in northeastern Mexico, growing at elevations of 6000°–8000° on the hills east of the Mexican table-lands.

Occasionally cultivated in the gardens of southern France and of Algeria.

6. Juniperus pachyphlæa Torr. Juniper. Checkered-bark Juniper.

Leaves appressed, acute and apiculate at apex, thickened, obscurely keeled and glandular on the back, bluish green, rather less than $\frac{1}{8}'$ long; on vigorous shoots and young branchlets linear-lanceolate, tipped with slender elongated points, and pale blue-green like the young branchlets. **Flowers** opening in February and March: the male stout, $\frac{1}{8}'$ long, with 10 or 12 stamens, their connectives broadly ovate, obscurely keeled on the back, short-

Fig. 83

pointed: scales of the female flower, ovate, acuminate, and spreading. **Fruit** ripening in the autumn of its second season, subglobose to short-oblong, irregularly tuberculate, $\frac{1}{3}'$–$\frac{1}{2}'$ in diameter, usually marked with the short tips of the flower-scales, occasionally opening and discharging the seeds at the apex, dark red-brown, more or less covered with

a glaucous bloom, especially during the first season and then occasionally bluish in color, with a thin skin closely investing the thick dry mealy flesh, and usually 4 seeds; seeds acute or obtusely pointed, conspicuously ridged and gibbous on the back, with a thick shell and 2 cotyledons.

A tree, often 50°–60° high, with a short trunk 3°–5° in diameter, long stout spreading branches forming a broad-based pyramidal or ultimately a compact round-topped head, and slender branchlets covered after the disappearance of the leaves with thin light red-brown usually smooth close bark occasionally broken into large thin scales. **Bark** $\frac{3}{4}'$–4′ thick, on young stems reddish brown becoming on old trunks whitish, deeply fissured and divided into nearly square plates 1′–2′ long, and separating on the surface into small thin closely appressed scales. **Wood** light, soft, not strong, brittle, close-grained, clear light red often streaked with yellow, with thin nearly white sapwood; often producing vigorous shoots from the base of the trunk or from the stumps of felled trees.

Distribution. Dry arid mountain slopes usually at elevations of 4000°–6000° above the sea, from the Eagle and Limpio mountains in southwestern Texas, westward along the desert ranges of New Mexico and Arizona, extending northward to the lower slopes of many of the high mountains of northern Arizona, and southward into Mexico.

7. Juniperus occidentalis Hook. Juniper.

Leaves opposite or ternate, closely appressed, acute or acuminate, rounded and conspicuously glandular on the back, denticulately fringed, gray-green, about $\frac{1}{8}'$ long. **Flowers:** male stout, obtuse, with 12–18 stamens, their connectives broadly ovoid, rounded,

Fig. 84

acute or apiculate and scarious or slightly ciliate on the margins: scales of the female flower ovate, acute, spreading, mostly obliterated from the fruit. **Fruit** subglobose or short-oblong, $\frac{1}{4}'$–$\frac{1}{3}'$ in diameter, with a thick firm blue-black skin coated with a glaucous bloom, thin dry flesh filled with large resin-glands, and 2 or 3 seeds; seeds ovoid, acute, rounded and deeply grooved or pitted on the back, flattened on the inner surface, about $\frac{1}{8}'$ long, with a thick bony shell, a thin brown inner seed-coat, and 2 cotyledons.

A tree, occasionally 60° high, with a tall straight trunk 2°–3° in diameter, more often not more than 20° in height, with a short trunk sometimes 10° in diameter, enormous branches, spreading at nearly right angles and forming a broad low head, and stout branchlets covered after the leaves fall with thin bright red-brown bark broken into loose papery scales; frequently when growing on dry rocky slopes and toward the northern limits of its range a shrub, with many short erect or semi-prostrate stems. **Bark** about

½′ thick, bright cinnamon-red, divided by broad shallow fissures into wide flat irregularly connected ridges separating on the surface into thin lustrous scales. **Wood** light, soft, very close-grained, exceedingly durable, light red or brown, with thick nearly white sapwood; used for fencing and fuel. The fruit is gathered and eaten by the California Indians.

Distribution. Mountain slopes and high prairies of western Idaho and of eastern Washington to the eastern slopes of the Cascade Mountains; eastern and southern Oregon up to altitudes of 4500°; along the summits and upper slopes of the Sierra Nevada of California, and southward to the San Bernardino Mountains, here abundant in Bear and Holcomb valleys; attaining its greatest trunk diameter on the wind-swept peaks of the California sierras, usually at altitudes between 6000° and 10,000° above the sea.

8. Juniperus monosperma Sarg. Juniper.

Leaves opposite or ternate, often slightly spreading at apex, acute or occasionally acuminate, much thickened and rounded on the back, usually glandular, denticulately fringed, gray-green, rather less than ⅛′ long, turning bright red-brown before falling; on vigorous shoots and young plants ovate, acute, tipped with long rigid points, thin, con-

Fig. 85

spicuously glandular on the back, often ½′ long. **Flowers**: male with 8–10 stamens, their broadly ovate, rounded or pointed connectives slightly erose on the margins: female with spreading pointed scales. **Fruit** subglobose or short-oblong, ⅛′–¼′ long, dark blue or perhaps occasionally light chestnut-brown with a thick firm skin covered with a thin glaucous bloom, thin flesh, and 1 or rarely 2 seeds; **seeds** often protruding from the top of the fruit, ovoid, often 4-angled, somewhat obtuse at apex, with a small hilum, and 2 cotyledons.

A tree, occasionally 40°–50° high, with a stout much-lobed and buttressed trunk sometimes 3° in diameter, short stout branches forming an open very irregular head, and slender branchlets covered after the falling of the leaves with light red-brown bark spreading freely into thin loose scales; more often a much branched shrub sometimes only a few feet high. **Bark** ashy gray, divided into irregularly connected ridges, separating into long narrow persistent shreddy scales. **Wood** heavy, slightly fragrant, light reddish brown, with nearly white sapwood and eccentric layers of annual growth; largely used for fencing and fuel. The fruit is ground into flour and baked by the Indians, who use the thin strips of fibrous bark in making saddles, breechcloths, and sleeping-mats.

Distribution. Along the eastern base of the Rocky Mountains from the valley of the Platte River, Wyoming (near Alcova, Natrona County) and the divide between the

Platte and Arkansas rivers in Colorado; western Oklahoma (near Kenton, Cimarron County, common) and western Texas; on the Colorado plateau, northern Arizona; over the mountain ranges of southwestern Wyoming, Nevada, southern New Mexico and Arizona, and southward into northern Mexico; often covering, with the Nut Pine, in southern Colorado and Utah, and in northern and central New Mexico and Arizona, great areas of rolling hills 6000°–7000° above the sea-level; reaching its largest size in northern Arizona.

9. Juniperus mexicana Spreng. Cedar. Rock Cedar.

Juniperus sabinoides Nees.

Leaves usually opposite or ternate, thickened and keeled on the back, obtuse or acute at apex, mostly without glands, denticulately fringed, rather more than $\frac{1}{16}'$ long, dark blue-green, on vigorous young shoots and seedling plants lanceolate, long-pointed, rigid,

Fig. 86

$\frac{1}{4}'$–$\frac{1}{2}'$ long. **Flowers:** male with 12–18 stamens, their connectives ovoid, obtuse, or slightly cuspidate: scales of the female flower ovate, acute, and spreading, very conspicuous when the fruit is half grown, becoming obliterated at its maturity. **Fruit** short-oblong to subglobose, $\frac{1}{4}'$–$\frac{1}{2}'$ in diameter, dark blue, with a thin skin covered with a glaucous bloom, sweet resinous flesh, and 1 or 2 seeds; **seeds** ovoid, acute, slightly ridged, rarely tuberculate, dark chestnut-brown, with a small hilum, a thin outer seed-coat, a membranaceous dark brown inner coat, and 2 cotyledons.

A tree, occasionally 100° but generally not more than 20°–30° high, with a short or elongated slightly lobed trunk seldom exceeding a foot in diameter, small spreading branches forming a wide round-topped open and irregular or a narrow pyramidal head, slender sharply 4-angled branchlets becoming terete after the falling of the leaves, light reddish brown or ashy gray, with smooth or slightly scaly bark; often a shrub, with numerous spreading stems. **Bark** on old trees $\frac{1}{4}'$–$\frac{1}{2}'$ thick, brown tinged with red, and divided into long narrow slightly attached scales persistent for many years and clothing the trunk with a loose thatch-like covering. **Wood** light, hard, not strong, slightly fragrant, brown streaked with red; largely used for fencing, fuel, telegraph-poles, and railway-ties.

Distribution. From Brazos County over the low limestone hills of western and southern Texas, and southward into Mexico; forming great thickets and growing to its largest size on the San Bernardo River; much smaller farther westward, and usually shrubby at the limits of vegetation on the high mountains of central Mexico.

10. Juniperus virginiana L. Red Cedar. Savin.

Leaves usually opposite, acute or acuminate or occasionally obtuse, rounded and glandular or eglandular on the back, about $\frac{1}{16}'$ long, dark blue-green or glaucous (var. *glauca* Carr.), at the north turning russet or yellow-brown during the winter, beginning in their third season to grow hard and woody, and remaining two or three years longer on the branches, on young plants and vigorous branchlets linear-lanceolate, long-pointed, light yellow-green, without glands, $\frac{1}{2}'$–$\frac{3}{4}'$ long. **Flowers:** dioecious or very rarely monoecious: male with 10 or 12 stamens, their connectives rounded and entire, with 4 or occasionally 5 or 6 pollen-sacs; scales of the female flower violet color, acute and spreading, becoming obliterated from the fruit. **Fruit** subglobose, $\frac{1}{4}'$–$\frac{1}{3}'$ in diameter, pale green when fully grown, dark blue and covered with a glaucous bloom at maturity, with a firm skin, thin

Fig. 87

sweetish resinous flesh, and 1 or 2 or rarely 3 or 4 seeds; **seeds** acute and occasionally apiculate at apex, $\frac{1}{6}'$–$\frac{1}{8}'$ long, with a comparatively small 2-lobed hilum, and 2 cotyledons.

A tree, occasionally 100° high, with a trunk 3°–4° in diameter, often lobed and eccentric, and frequently buttressed toward the base, generally not more than 40°–50° tall, with short slender branches horizontal on the lower part of the tree, erect above, forming a narrow compact pyramidal head, in old age usually becoming broad and round-topped or irregular, and slender branchlets terete after the disappearance of the leaves and covered with close dark brown bark tinged with red or gray; on exposed cliffs on the coast of Maine, sometimes only a few inches high with long branches forming broad dense mats. **Bark** $\frac{1}{8}'$–$\frac{1}{4}'$ thick, light brown tinged with red, and separated into long narrow scales fringed on the margins, and persistent for many years. **Wood** light, close-grained, brittle, not strong, dull red, with thin nearly white sapwood, very fragrant, easily worked; largely used for posts, the sills of buildings, the interior finish of houses, the lining of closets and chests for the preservation of woolens against the attacks of moths, and largely for pails and other small articles of woodenware, and now for lead pencils. A decoction of the fruit and leaves is used in medicine, and oil of red cedar distilled from the leaves and wood as a perfume.

Distribution. Dry gravelly slopes and rocky ridges, often immediately on the seacoast, from southern Nova Scotia and New Brunswick to the coast of Georgia, the interior of southern Alabama and Mississippi, and westward to the valley of the lower Ottawa River, southern Michigan, eastern North and South Dakota, Nebraska and Kansas, and eastern Texas, not ascending the mountains of New England and New York nor the high southern Alleghanies; in middle Kentucky and Tennessee, and northern Alabama and Mississippi,

covering great areas of low rolling limestone hills with nearly pure forests of small bushy trees.

Often cultivated, in several forms, in the northern and eastern states as an ornamental tree and occasionally in the gardens of western and central Europe.

11. Juniperus lucayana Britt. Red Cedar.

Juniperus barbadensis Sarg. not L.

Leaves usually opposite, narrow, acute, or gradually narrowed above the middle and acuminate, marked on the back by conspicuous oblong glands. **Flowers** opening in early March: male elongated, $\frac{1}{8}'$ to nearly $\frac{1}{4}'$ long, with 10 or 12 stamens, their connectives rounded, entire, and bearing usually 3 pollen-sacs: female with scales gradually narrowed above the middle, acute at apex, and obliterated from the ripe fruit. **Fruit** subglobose to short-oblong, dark blue, covered when ripe with a glaucous bloom, about $\frac{1}{2}\frac{1}{4}'$ in diameter, with a thin skin, sweet resinous flesh, and 1 or 2 seeds; **seeds** acute, prominently ridged.

Fig. 88

A tree, sometimes 50° high, with a trunk occasionally 2° in diameter, small branches erect when the tree is crowded in the forest, spreading when it has grown in open ground and forming a broad flat-topped head often 30° or 40° in diameter, long thin secondary branches erect at the top of the tree and pendulous below, and pendulous branchlets about $\frac{1}{2}\frac{1}{4}'$ in diameter, becoming light red-brown or ashy gray at the end of four or five years after the disappearance of the leaves. **Bark** thin, light red-brown, separating into long thin scales. **Wood** light, close, straight-grained, fragrant, dull red; formerly exclusively used in the manufacture of the best lead pencils.

Distribution. Inundated river swamps from southern Georgia, southward to the shores of the Indian River, Florida, and on the west coast of Florida from the northern shores of Charlotte Harbor to the valley of the Apalachicola River, often forming great thickets under the shade of larger trees; along streams and creeks in low woods near Houston, Harris County, and Milano, Milam County, Texas (*E. J. Palmer*); common in the Bahamas, San Domingo, eastern Cuba, and on the mountains of Jamaica and Antigua.

Often planted for the decoration of squares and cemeteries in the cities and towns in the neighborhood of the coast from Florida to western Louisiana, and now often naturalized beyond the limits of its natural range on the Gulf coast; occasionally cultivated in the temperate countries of Europe, and in cultivation the most beautiful of the Junipers

12. Juniperus scopulorum Sarg. Red Cedar.

Leaves usually opposite, closely appressed, acute or acuminate, generally marked on the back by obscure elongated glands, dark green, or often pale and very glaucous. **Flowers:** male with about 6 stamens, their connectives rounded and entire, bearing 4 or 5 anther-sacs: scales of the female flower spreading, acute or acuminate, and obliterated from the mature fruit. **Fruit** ripening at the end of the second season, nearly globose, $\frac{1}{4}'$–$\frac{1}{3}'$ in diameter, bright blue, with a thin skin covered with a glaucous bloom, sweet resinous flesh, and 1 or usually 2 seeds; **seeds** acute, prominently grooved and angled, about $\frac{3}{16}'$ long, with a thick bony outer coat and a small 2-lobed hilum.

A tree, 30°–40° high, with a short stout trunk sometimes 3° in diameter, often divided near the ground into a number of stout spreading stems, thick spreading and ascending

Fig. 89

branches covered with scaly bark, forming an irregular round-topped head, and slender 4-angled branchlets becoming at the end of three or four years terete and clothed with smooth pale bark separating later into thin scales. **Bark** dark reddish brown or gray tinged with red, divided by shallow fissures into narrow flat connected ridges broken on the surface into persistent shredded scales.

Distribution. Scattered often singly over dry rocky ridges, usually at altitudes of 5000° or 6000° but occasionally ascending in Colorado to 9000° above the sea, from the eastern foothill region of the Rocky Mountains from Alberta to the Black Hills of South Dakota, the valley of the Niobrara River, Sheridan County, northwestern Nebraska (*J. M. Bates*) and to western Texas and eastern and northern New Mexico, and westward to eastern Oregon, Nevada, and northern Arizona; descending to the sea-level in Washington on the shores of the northern part of Puget Sound and on the islands and mainland about the Gulf of Georgia, British Columbia.

II. TAXACEÆ.

Slightly resinous trees and shrubs, producing when cut vigorous stump shoots, with fissured or scaly bark, light-colored durable close-grained wood, slender branchlets, linear-lanceolate entire rigid acuminate spirally disposed leaves, usually appearing 2-ranked by a twist in their short compressed petioles and persistent for many years, and small ovoid acute buds. Flowers opening in early spring from buds formed the previous autumn, dicœcious or moncœcious, axillary and solitary, surrounded by the persistent decussate scales of the buds, the male composed of numerous filaments united into a column,

each filament surmounted by several more or less united pendant pollen-cells; the female of a single erect ovule, becoming at maturity a seed with a hard bony shell, raised upon or more or less surrounded by the enlarged and fleshy aril-like disk of the flower; embryo axile, in fleshy ruminate or uniform albumen; cotyledons 2, shorter than the superior radicle. Of the ten genera widely distributed over the two hemispheres, two occur in North America.

CONSPECTUS OF THE NORTH AMERICAN GENERA.

Filaments dilated into 4 pollen-sacs united into a half ring; seeds drupe-like, green or purple, ripening at the end of the second season; albumen ruminate. 1. **Torreya.**

Filaments dilated into a globose head of 4–8 connate pollen-sacs; seeds berry-like, scarlet, ripening at the end of the first season; albumen uniform. 2. **Taxus.**

1. TORREYA ARN.

Tumion Raf.

Glabrous fœtid or pungent aromatic trees, with fissured bark and verticillate or opposite spreading or drooping branches. Leaves thin, long-pointed, abruptly contracted at base, dark green, lustrous and slightly rounded above, thickened and revolute on the margins, with pale bands of stomata on each side of the midvein on the lower surface. Flowers dicœcious; the male crowded in the axils of adjacent leaves, on shoots of the previous year, oval or oblong, composed of 6 or 8 close whorls each of 4 stamens, subverticillately arranged on a slender axis; filaments stout and expanded above into 4 globose yellow pollen-sacs united into a half ring, their connectives produced above the cells; the female on shoots of the year less numerous and scattered, sessile, the ovule surrounded by and finally inclosed in an ovoid urn-shaped fleshy sac, and becoming at the end of the second season an oblong-ovate yellow-brown seed, rounded and apiculate at apex, acute and marked at base by the large dark hilum; seed-coat thick and woody, its inner layer folded into the thick white albumen, surrounded and finally inclosed in the thick green or purple enlarged disk of the flower composed of thin flat easily separable fibers, splitting longitudinally when ripe into two parts and separating from the basal scales persistent on the short stout stalk of the seed.

Torreya is now confined to Florida and Georgia, western California, Japan, the island of Quelpart, and central and northern China. Four species are recognized. Of the exotic species the Japanese *Torreya nucifera* S. & Z. is occasionally cultivated in the eastern states.

The genus is named in honor of Dr. John Torrey, the distinguished American botanist.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Leaves slightly rounded on the back, pale below; leaves, branches, and wood fœtid; branchlets gray or yellowish green. 1. **T. taxifolia** (C).

Leaves nearly flat, green below; leaves, branches and wood pungent-aromatic; branchlets reddish brown. 2. **T. californica** (G).

1. Torreya taxifolia Arn. Stinking Cedar. Torreya.

Tumion taxifolium Greene.

Leaves slightly falcate, 1½′ long, about ⅛′ wide, somewhat rounded, dark green and lustrous above, paler and marked below with broad bands of stomata. **Flowers** appearing in March and April; male with pale yellow anthers; female broadly ovoid, with a dark purple fleshy covering to the ovule, ⅛′ long, and inclosed at the base by broad thin rounded scales. **Seed** fully grown at midsummer, slightly obovoid, dark purple, 1′–1¼′ long, ¾′ thick, with a thin leathery covering, a light red-brown seed-coat furnished on the inner surface with 2 opposite

longitudinal thin ridges extending from the base toward the apex, and conspicuously ruminate albumen.

A tree, occasionally 40° high, with a short trunk 1°–2° in diameter, whorls of spreading slightly pendulous branches forming a rather open pyramidal head tapering from a broad base. **Bark** ½′ thick, brown faintly tinged with orange color, and irregularly divided by

Fig. 90

broad shallow fissures into wide low ridges slightly rounded on the back and covered with thin closely appressed scales. **Wood** hard, strong, clear bright yellow, with thin lighter colored sapwood; largely used for fence-posts.

Distribution. On bluffs along the eastern bank of the Apalachicola River, Florida, from River Junction to the neighborhood of Bristol, Liberty County, and in the southwestern corner of Decatur County, Georgia (*R. M. Harper*). Rare and local.

Now often planted in the public grounds and gardens of Tallahassee, Florida.

2. Torreya californica Torr. California Nutmeg.

Tumion californicum **Greene.**

Leaves slightly falcate, nearly flat, dark green and lustrous on the upper, somewhat paler and marked below with a narrow band of stomata, tipped with slender callous

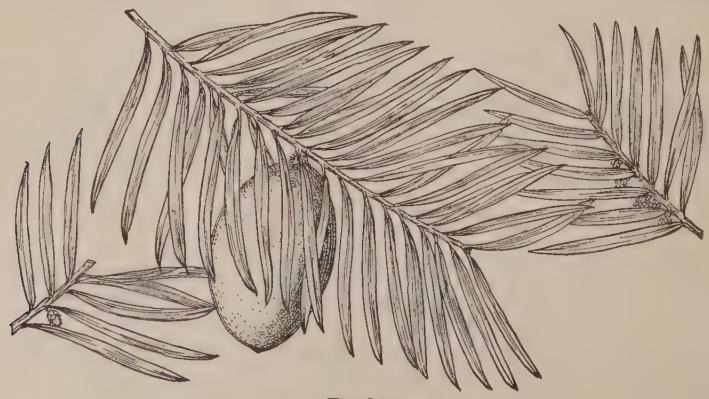

Fig. 91

points, 1′–3½′ long, $\frac{1}{16}$′–⅛′ wide. **Flowers** appearing in March and April; male with broadly ovate acute scales; female nearly ¼′ long, with oblong-ovate rounded scales. **Seed** ovoid or oblong-ovoid, 1′–1½′ long, light green more or less streaked with purple.

A tree, 50°–70° but occasionally 100° high, with a trunk 1°–2° or rarely 4° in diameter, and whorls of spreading slender slightly pendulous branches forming a handsome pyramidal and in old age a round-topped head. **Bark** ⅛′–½′ thick, gray-brown tinged with orange color, deeply and irregularly divided by broad fissures into narrow ridges covered with elongated loosely appressed plate-like scales. **Wood** light, soft, close-grained, clear light yellow, with thin nearly white sapwood; occasionally used for fence-posts.

Distribution. Borders of mountain streams, California, nowhere common but widely distributed from Mendocino County to the Santa Cruz Mountains in the coast region and along the western slopes of the Sierra Nevada from Eldorado to Tulare Counties at altitudes of 3000°–5000° above the sea; most abundant and of its largest size on the northern coast ranges.

Rarely cultivated as an ornamental tree in California and western Europe.

2. TAXUS L. Yew.

Trees or shrubs, with brown or dark purple scaly bark, and spreading usually horizontal branches. Leaves flat, often falcate, gradually narrowed at the base, dark green, smooth and keeled on the upper surface, paler, papillate, and stomatiferous on the lower surface, their margins slightly thickened and revolute. Flowers dicœcious or monœcious: the male composed of a slender stipe bearing at the apex a globular head of 4–8 pale yellow stamens consisting of 4–6 conic pendant pollen-sacs peltately connate from the end of a short filament; the female sessile in the axils of the upper scale-like bracts of a short axillary branch, the ovule erect, sessile on a ring-like disk, ripening in the autumn into an ovoid-oblong seed gradually narrowed and short-pointed at apex, marked at base by the much-depressed hilum, about ⅓′ long, entirely or nearly surrounded by but free from the now thickened succulent translucent sweet scarlet aril-like disk of the flower open at apex; seed-coat thick, of two layers, the outer thin and membranaceous or fleshy, the inner much thicker and somewhat woody; albumen uniform.

Taxus with six or seven species, which can be distinguished only by their leaf characters and habit, is widely distributed through the northern hemisphere, and is found in eastern North America where two species occur, in Pacific North America, Mexico, Europe, northern Africa, western and southern Asia, China, and Japan. Of the exotic species the European, African, and Asiatic *Taxus baccata* L., and its numerous varieties, is often cultivated in the United States, especially in the more temperate parts of the country, and is replaced with advantage by the hardier *Taxus cuspidata* S. & Z., of eastern Asia in the northern states, where the native shrubby *Taxus canadensis* Marsh, with *monœcious* flowers is sometimes cultivated.

Taxus, from *τάξος*, is the classical name of the Yew-tree.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT SPECIES.

Leaves usually short, yellow-green.	1. **T. brevifolia** (G).
Leaves elongated, usually falcate, dark green.	2. **T. floridana** (C).

1. Taxus brevifolia Nutt. Yew.

Leaves ½′–1′ long, about $\frac{1}{16}$′ wide, dark yellow-green above, rather paler below, with stout midribs, and slender yellow petioles $\frac{1}{12}$′ long, persistent for 5–12 years. **Flowers** and **fruit** as in the genus.

A tree, usually 40°–50° but occasionally 70°–80° high, with a tall straight trunk 1°–2° or rarely 4½° in diameter, frequently unsymmetrical, with one diameter much exceeding the other, and irregularly lobed, with broad rounded lobes, and long slender horizontal or slightly pendulous branches forming a broad open conical head. **Bark** about ¼′ thick

and covered with small thin dark red-purple scales. **Wood** heavy, hard, strong, bright red, with thin light yellow sapwood; used for fence-posts and by the Indians of the northwest coast for paddles, spear-handles, bows, and other small articles.

Fig. 92

Distribution. Banks of mountain streams, deep gorges, and damp ravines, growing usually under large coniferous trees; nowhere abundant, but widely distributed usually in single individuals or in small clumps from the extreme southern part of Alaska, southward along the coast ranges of British Columbia, Washington, and Oregon, where it attains its greatest size; along the coast ranges of California as far south as the Bay of Monterey, and along the western slopes of the Sierra Nevada to Tulare County at altitudes between 5000° and 8000° above the sea-level, ranging eastward in British Columbia to the Selkirk Mountains, and over the mountains of Washington and Oregon to the western slopes of the continental divide in northern Montana; in the interior much smaller than near the coast and often shrubby in habit.

Occasionally cultivated in the gardens of western Europe.

2. Taxus floridana Chapm. Yew.

Leaves usually conspicuously falcate, $\frac{3}{4}'$ to nearly $1'$ long, $\frac{1}{16}'$–$\frac{1}{12}'$ wide, dark green above, pale below, with obscure midribs and slender petioles about $\frac{1}{16}'$ in length. **Flowers** appearing in March. **Fruit** ripening in October.

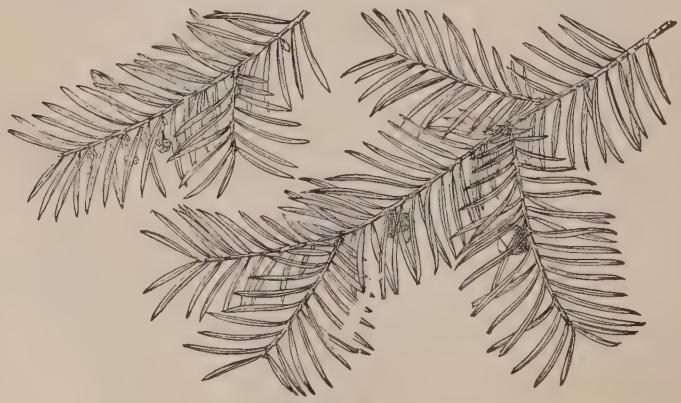

Fig. 93

A bushy tree, rarely 25° high, with a short trunk occasionally 1° in diameter, and numerous stout spreading branches; more often shrubby in habit and 12°–15° tall. **Bark** $\frac{1}{8}$′ thick, dark purple-brown, smooth, compact, occasionally separating into large thin irregular plate-like scales. **Wood** heavy, hard, very close-grained, dark brown tinged with red, with thin nearly white sapwood.

Distribution. River bluffs and ravines on the eastern bank of the Apalachicola River, in Gadsden County, Florida, from Aspalaga to the neighborhood of Bristol.

Class 2. ANGIOSPERMÆ.

Carpels or pistils consisting of a closed cavity containing the ovules and becoming the fruit.

Division 1. Monocotyledons.

Stems with woody fibres distributed irregularly through them, but without pith or annual layers of growth. Parts of the flower in 3's; ovary superior; embryo with a single cotyledon. Leaves parallel-veined, alternate, long-persistent, without stipules.

III. PALMÆ.

Trees, growing by a single terminal bud, with stems covered with a thick rind, usually marked below by the ring-like scars of fallen leaf-stalks, and clothed above by their long-persistent sheaths; occasionally stemless. Leaves clustered at the top of the stem, plaited in the bud, fan-shaped or pinnate, their rachis sometimes reduced to a narrow border, long-stalked, with petioles dilated into clasping sheaths of tough fibres (*vaginas*); on fan-shaped leaves, furnished at the apex on the upper side with a thickened concave body (*ligule*). Flowers minute, perfect or unisexual, in the axils of small thin mostly deciduous bracts, in large compound clusters (*spadix*) surrounded by boat-shaped bracts (*spathes*); sepals and petals free or more or less united; stamens usually 6; anthers 2-celled, introrse, opening longitudinally; ovary 3-celled, with a single ovule in each cell; styles 1–3. Fruit a drupe or berry; embryo cylindric in a cavity of the hard albumen near the circumference of the seed. Of the 130 genera now usually recognized and chiefly inhabitants of the tropics, seven have arborescent representatives in the United States.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT GENERA.

Leaves fan-shaped.
- Leaf-stalks unarmed.
  - Calyx and corolla united into a short 6-lobed perianth.
    - Fruit white, drupaceous; albumen even. **1. Thrinax.**
    - Fruit black, baccate; albumen channeled. **2. Coccothrinax.**
  - Calyx and corolla distinct; fruit baccate. **3. Sabal.**
- Leaf-stalks armed with marginal spines.
  - Filaments slender, free; fruit baccate. **4. Washingtonia.**
  - Filaments triangular, united into a cup adnate to the base of the corolla; fruit drupaceous. **5. Acœlorraphe.**

Leaves pinnate.
- Flower-clusters produced on the stem below the leaves; fruit violet-blue. **6. Roystonea.**
- Flower-clusters produced from among the leaves; fruit bright orange-scarlet. **7. Pseudophœnix.**

1. THRINAX Sw.

Small unarmed trees, with stems covered with pale gray rind. Leaves orbicular, or truncate at the base, thick and firm, usually silvery white on the lower surface, divided

to below the middle into narrow acuminate parted segments with thickened margins and midribs; rachis a narrow border, with thin usually undulate margins; ligule thick, concave, pointed, lined while young with hoary tomentum; petioles compressed, rounded above and below, thin and smooth on the margins, with large clasping bright mahogany-red sheaths of slender matted fibres covered with thick hoary tomentum. Spadix interfoliar, stalked, its primary branches short, alternate, flattened, incurved, with numerous slender rounded flower-bearing branchlets; spathes numerous, tubular, coriaceous, cleft and more or less tomentose at the apex. Flowers opening in May and June, and occasionally irregularly in the autumn, solitary, perfect; perianth 6-lobed; stamens inserted on the base of the perianth, with subulate filaments thickened and only slightly united at the base, or nearly triangular and united into a cup adnate to the perianth, and oblong anthers; ovary 1-celled, gradually narrowed into a stout columnar style crowned by a large funnel-formed flat or oblique stigma; ovule basilar, erect. Fruit a globose drupe with juicy bitter ivory-white flesh easily separable from the thin-shelled tawny brown nut. Seed free, erect, slightly flattened at the ends, with an oblong pale conspicuous subbasilar hilum, a short-branched raphe, a thin coat, and uniform albumen more or less deeply penetrated by a broad basal cavity; embryo lateral.

Thrinax is confined to the tropics of the New World and is distributed from southern Florida through the West Indies to the shores of Central America. Seven or eight species are now generally recognized.

The wood of the Florida species is light and soft, with numerous small fibro-vascular bundles, the exterior of the stem being much harder than the spongy interior. The stems are used for the piles of small wharves and turtle-crawls, and the leaves for thatch, and in making hats, baskets, and small ropes.

Thrinax, from θρῖναξ, is in allusion to the shape of the leaves.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Flowers on elongated pedicels; perianth obscurely lobed; stamens much exserted, their filaments subulate, barely united at base; stigma oblique; cavity of the seed extending to the apex.

Perianth obscurely lobed; style abruptly enlarged into a large oblique stigma; leaves silvery white on the lower surface. **1. T. floridana** (D).

Perianth deeply lobed; style narrowed gradually into a small oblique stigma; leaves green on both surfaces. **2. T. Wendlandiana** (D).

Flowers on short pedicels; lobes of the perianth ovate, acuminate; filaments nearly triangular, united below into a cup; stigma flat; cavity of the seed extending only to the middle.

Seeds pale chestnut-brown; spadix about 6° long; leaves 3°–4° in diameter. **3. T. keyensis** (D).

Seeds dark chestnut-brown; spadix less than 3° long; leaves not over 2° in diameter. **4. T. microcarpa** (D).

1. Thrinax floridana Sarg. Thatch.

Leaves $2\frac{1}{2}°$–3° in diameter, rather longer than broad, yellow-green and lustrous on the upper surface, silvery white on the lower surface, with a long-pointed, bright orange-colored ligule $\frac{3}{4}'$ long and broad; petioles 4°–$4\frac{1}{2}°$ long, pale yellow-green or orange color toward the apex, coated at first with hoary deciduous tomentum, much thickened and tomentose toward the base. **Flowers:** spadix 3°–$3\frac{1}{2}°$ long, the primary branches 6′–8′ long and ivory-white, flower-bearing branches $1\frac{1}{2}'$–2′ in length; flowers on slender pedicels nearly $\frac{1}{8}'$ long, ivory-white, very fragrant, with an obscurely-lobed perianth, much exserted stamens barely united at the base, and a large stigma. **Fruit** $\frac{3}{8}'$ in diameter, somewhat depressed at the ends; **seed** from $\frac{1}{8}'$ to nearly $\frac{1}{4}'$ in diameter, dark chestnut-brown.

A tree, with a slightly tapering stem 20°–30° high and 4′–6′ in diameter, clothed to the middle and occasionally almost to the ground with the sheaths of dead leaf-stalks.

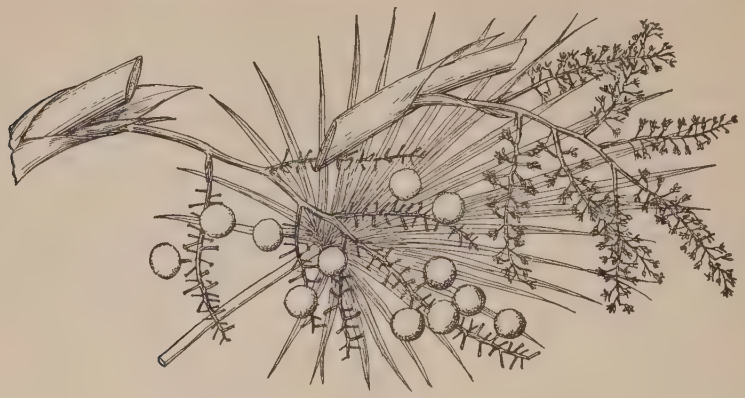

Fig. 94

Distribution. Florida, dry coral ridges and sandy shores of keys from Long Key to Torch Key, and on the mainland from Cape Romano to Cape Sable.

2. Thrinax Wendlandiana Becc. Thatch.

Leaves $2\frac{1}{2}$°–3° in diameter, orbicular, pale yellow-green, lustrous above, with a thick concave ligule, acuminate or rarely rounded at apex; petioles 2°–4° long, much thick-

Fig. 95

ened and tomentose toward the base. **Flowers:** spadix stalked, 2°–4° long, its primary branches short, flattened, incurved, with numerous terete flower-bearing branchlets; flowers on slender pedicels $\frac{1}{10}$′–$\frac{1}{8}$′ long, with a deeply lobed perianth, the lobes nearly

triangular, acuminate, and a small stigma. **Fruit** $\frac{1}{4}'$–$\frac{3}{8}'$ in diameter, globose; **seed** from $\frac{1}{8}'$–$\frac{1}{4}'$ in diameter, dark chestnut-brown.

A tree, in Florida, with a smooth pale trunk 20°–25° high and 3′–4′ in diameter.

Distribution. Florida: Dade County, Madeira Hammock, Pumpkin Key, Flamingo, and northwest of Cape Sable; also in Cuba and on Mugueres Island, Gulf of Honduras.

3. Thrinax keyensis Sarg. Thatch.

Leaves rather longer than broad, 3°–4° long, the lowest segments parallel with the petiole or spreading from it nearly at right angles, light yellow-green and lustrous on the upper surface, with bright orange-colored margins, below coated while young with deciduous hoary tomentum and pale blue-green and more or less covered with silvery white pubescence at maturity, with a thick pointed ligule 1′ long and wide, lined at first with hoary tomentum; petioles flattened above, obscurely ridged on the lower surface, tomentose while young, pale blue-green, 3°–4° long. **Flowers:** spadix usually about 6° long, spreading and gracefully incurved, with spathes more or less coated with hoary tomentum, large compressed primary branches, and short bright orange-colored flower-bearing branches;

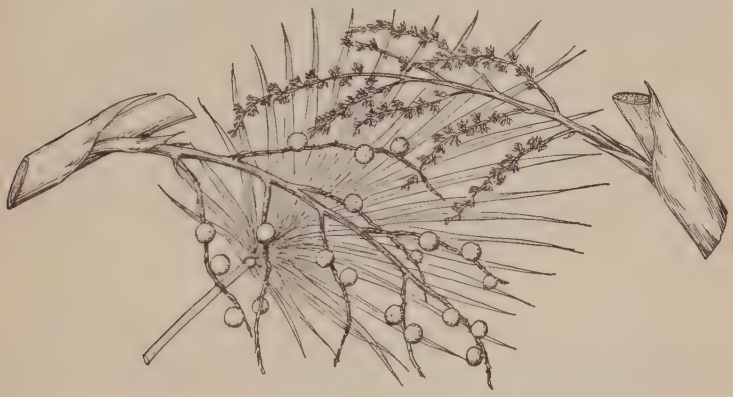

Fig. 96

flowers on short thick disk-like pedicels, about $\frac{1}{8}'$ long, white, slightly fragrant, with a tubular perianth, the lobes broadly ovate and acute, stamens with nearly triangular filaments united at the base, and a flat stigma. **Fruit** $\frac{1}{16}'$ to nearly $\frac{1}{4}'$ in diameter; **seed** brown, $\frac{3}{16}'$ in diameter.

A tree, with a stem often 25° high and 10′–14′ in diameter, raised on a base of thick matted roots 2°–3° high and 18′–20′ in diameter, and a broad head of leaves, the upper erect, the lower pendulous and closely pressed against the stem.

Distribution. Dry, sandy soil close to the beach on the north side of the largest of the Marquesas Keys, and on Crab Key, a small island to the westward of Torch Key, one of the Bahia Honda group, Florida; on the Bahamas.

4. Thrinax microcarpa Sarg. Silvertop Palmetto. Brittle Thatch.

Leaves 2°–3° across, pale green above, silvery white below, more or less thickly coated while young with hoary tomentum, especially on the lower surface, divided near the base almost to the rachis, with an orbicular thick concave ligule lined with a thick coat of white tomentum; petioles thin and flexuose. **Flowers:** spadix elongated, with short, compressed erect branches slightly spreading below, numerous slender pendulous flower-bearing branches, and long acute spathes deeply parted at the apex, coriaceous and coated above the middle with thick hoary tomentum; flowers on short thick disk-like pedicels, with a

cupular perianth, the lobes broadly ovate and acute, stamens with thin nearly triangular exserted filaments slightly united at base and oblong anthers becoming reversed and extrorse at maturity, and a deep orange-colored ovary narrowed above into a short thick

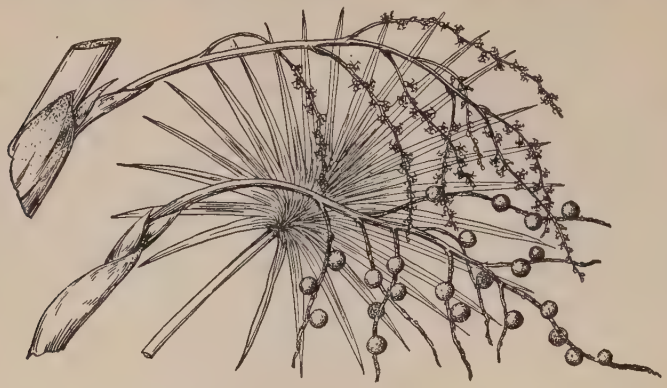

Fig. 97

style dilated into a large funnel-formed stigma. **Fruit** globose, $\frac{1}{8}'$ in diameter; **seed** subglobose, bright to dark chestnut-brown, depressed.

A tree, rarely more than 30° high, with a trunk 8′–10′ in diameter.

Distribution. Dry coral soil, on the shores of Sugar Loaf Sound, and on No Name and Bahia Honda keys, Florida; in Cuba.

2. COCCOTHRINAX Sarg.

Small unarmed trees, with simple or clustered stems or rarely stemless. Leaves orbicular, or truncate at base, pale or silvery white on the lower surface, divided into narrow obliquely folded segments acuminate and divided at apex; rachis narrow; ligules thin, free, erect, concave, pointed at the apex; petioles compressed, slightly rounded and ridged above and below, thin and smooth on the margins, gradually enlarged below into elongated sheaths of coarse fibres forming an open network covered while young by thick hoary tomentum. Spadix interfoliar, paniculate, shorter than the leaf-stalks, its primary branches furnished with numerous short slender pendulous flower-bearing secondary branches; spathes numerous, papery, cleft at the apex. Flowers solitary, perfect, jointed on elongated slender pedicels; perianth cup-shaped, obscurely lobed; stamens 9, inserted on the base of the perianth, with subulate filaments enlarged and barely united at the base, and oblong anthers; ovary 1-celled, narrowed into a slender style crowned by a funnel-formed oblique stigma; ovule basilar, erect. Fruit a subglobose berry raised on the thickened torus of the flower, with thick juicy black flesh. Seed free, erect, depressed-globose, with a thick hard vertically grooved shell deeply infolded in the bony albumen; hilum subbasilar, minute; raphe hidden in the folds of the seed-coat; embryo lateral.

Coccothrinax is confined to the tropics of the New World. Two species, of which one is often stemless northward, inhabit southern Florida, and at least two other species are scattered over several of the West Indian islands.

Coccothrinax, from κόκκος and *Thrinax*, is in allusion to the berry-like fruit.

1. Coccothrinax jucunda Sarg. Brittle Thatch.

Leaves nearly orbicular, the lower segments usually parallel with the petiole, thin and brittle, 18′–24′ in diameter, divided below the middle of the leaf or toward its base nearly

to the ligule, with much-thickened bright orange-colored midribs and margins, pale yellow-green and lustrous on the upper surface, bright silvery white and coated at first on the lower surface with hoary deciduous pubescence, with a thin undulate obtusely short-pointed dark orange-colored rachis, and a thin concave crescent-shaped often oblique slightly undulate short-pointed and light or dark orange-colored ligule $\frac{3}{4}'$ wide, $\frac{1}{3}'$ deep; petioles slender, pale yellow-green, $2\frac{1}{2}°$–$3°$ long. **Flowers:** spadix 18′–24′ long, with flattened stalks, slender much-flattened primary branches 8′–10′ long, light orange-colored slender terete flower-bearing branches $1\frac{1}{2}'$–$3'$ long, and pale reddish brown spathes coated toward the ends with pale pubescence; flowers opening in June and irregularly also in the autumn on ridged spreading pedicels $\frac{1}{5}'$ long, with an orange-colored ovary surmounted by an elongated style dilated into a rose-colored stigma. **Fruit** ripening at the end of six

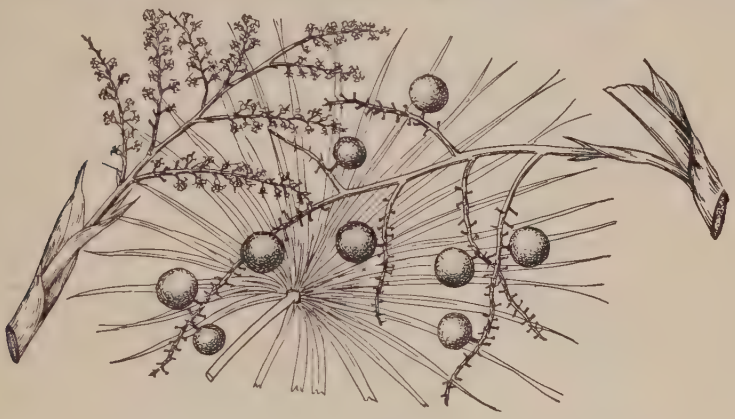

Fig. 98

months, from $\frac{1}{2}'$–$\frac{3}{4}'$ in diameter, bright green at first when fully grown, becoming deep violet color, with succulent very juicy flesh, ultimately black and lustrous; **seed** light tawny brown.

A tree, with a stem slightly enlarged from the ground upward, 15°–25° high, 4′–6′ thick, covered with pale blue rind, and surmounted by a broad head of leaves at first erect, then spreading and ultimately pendulous. **Wood** used for the piles of small wharves and turtle-crawls. The soft tough young leaves are made into hats and baskets.

Distribution. Dry coral ridges and sandy flats from the shores of Bay Biscayne along many of the southern keys to the Marquesas group (var. *marquesensis* Becc.) Florida; and on the Bahamas (var. *macrosperma* Becc.).

3. SABAL Adans. Palmetto.

Unarmed trees, with stout columnar stems covered with red-brown rind. Leaves flabellate, tough and coriaceous, divided into many narrow long-pointed parted segments plicately folded at base, often separating on the margins into narrow threads; rachis extending nearly to the middle of the leaves, rounded and broadly winged toward the base on the lower side, thin and acute on the upper side; ligule adnate to the rachis, acute, concave, with thin incurved entire margins; petioles rounded and concave on the lower side, conspicuously ridged on the upper side, acute and entire on the margins, with elongated chestnut-brown shining sheaths of stout fibres. Spadix interfoliar, stalked, decompound, with a flattened stem, short branches, slender densely flowered ultimate branches, and numerous acuminate spathes, the outer persistent and becoming broad and

woody. Flowers solitary, perfect; calyx tabular, unequally lobed, the lobes slightly imbricated in the bud; corolla deeply lobed, with narrow ovate-oblong concave acute lobes valvate at the apex in the bud; stamens 6, those opposite the corolla lobes rather longer than the others, with subulate filaments united below into a shallow cup adnate to the tube of the corolla, and ovoid anthers, their cells free and spreading at the base; ovary of 3 carpels, 3-lobed, 3-celled, gradually narrowed into an elongated 3-lobed style truncate and stigmatic at the apex; ovule basilar, erect. Fruit a small black 1 or 2 or 3-lobed short-stemmed berry with thin sweet dry flesh. Seed depressed-globose, marked on the side by the prominent micropyle, with a shallow pit near the minute basal hilum, a thin seed-coat, and a ventral raphe; embryo minute, dorsal, in horny uniform albumen penetrated by a hard shallow basal cavity filled by the thickening of the seed-coat.

Sabal belongs to the New World, and is distributed from the Bermuda Islands and the South Atlantic and Gulf states of North America through the West Indies to Venezuela and Mexico.

Of the eight species now recognized four inhabit the United States; of these two are small stemless plants.

The generic name is of uncertain origin.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT SPECIES.

Spadix short; fruit subglobose, 1-celled; seed-coat light chestnut color. 1. **S. Palmetto** (C).
Spadix elongated; fruit often 2 or 3-lobed; with 2 or 3 seeds; seed-coat dark chestnut-brown. 2. **S. texana** (E).

1. Sabal Palmetto R. & S. Cabbage Tree. Cabbage Palmetto.

Leaves 5°–6° long and 7°–8° broad, dark green and lustrous, deeply divided into narrow parted recurved segments, with ligules 4′ long and more or less unsymmetrical at apex; petioles 6°–7° long and $1\frac{1}{2}$′ wide at apex. **Flowers:** spadix 2°–$2\frac{1}{2}$° long, with slender incurved

Fig. 99

branches, slender ultimate divisions, and thin secondary spathes flushed with red at apex and conspicuously marked by pale slender longitudinal veins; flowers in the axils of minute deciduous bracts much shorter than the perianth, opening in June. **Fruit** ripening late in the autumn, subglobose or slightly obovoid, gradually narrowed at base, 1-seeded, about $\frac{1}{3}$′ in diameter; **seed** light bright chestnut-colored, $\frac{1}{4}$′ broad.

A tree, often 40°–50° and occasionally 80°–90° high, with a tall clear trunk often 2° in diameter, sometimes branched by the destruction of the terminal bud, divided by shallow

irregular interrupted fissures into broad ridges, with a short pointed knob-like underground stem surrounded by a dense mass of contorted roots often 4° or 5° in diameter and 5° or 6° deep, from which tough light orange-colored roots often nearly ½′ in diameter penetrate the soil for a distance of 15° or 20°, and a broad crown of leaves at first upright, then spreading nearly at right angles with the stem, and finally pendulous. **Wood** light, soft, pale brown, or occasionally nearly black, with numerous hard fibro-vascular bundles, the outer rim about 2′ thick and much lighter and softer than the interior. In the southern states the trunks are used for wharf-piles, and polished cross sections of the stem sometimes serve for the tops of small tables; the wood is largely manufactured into canes. From the sheaths of young leaves the bristles of scrubbing-brushes are made. The large succulent leaf-buds are cooked and eaten as a vegetable, and coarse hats, mats, and baskets are made from the leaves. Pieces of the spongy bark of the stem are used as a substitute for scrubbing-brushes.

Distribution. Sandy soil in the immediate neighborhood of the coast from the neighborhood of Cape Hatteras and Smith Island at the mouth of Cape Fear River, North Carolina, southward near the coast to northern Florida; in Florida extending across the peninsula and south to Upper Matecumbe Key, and along the west coast to Saint Andrews Bay. Most abundant and of its largest size on the west coast of the Florida peninsula.

Often planted as a street tree in the cities of the southern states.

2. Sabal texana Becc. Palmetto.

Sabal mexicana S. Wats., not Mart.

Leaves dark yellow-green and lustrous, 5°–6° long, often 7° wide, divided nearly to the middle into narrow divided segments, with thickened pale margins separating into long

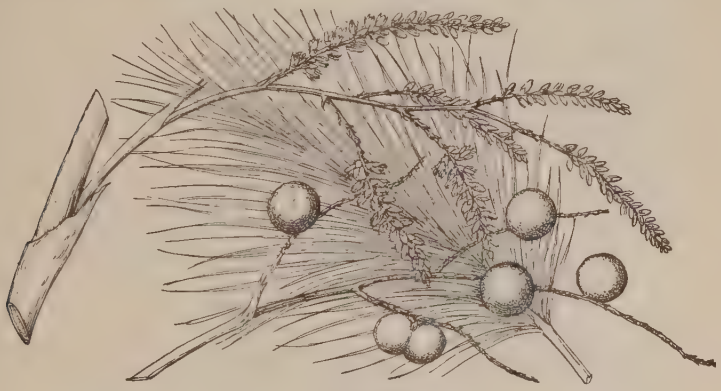

Fig. 100

thin fibres, with ligules about 6′ long; petioles 7°–8° long, 1½′ wide at the apex. **Flowers:** spadix 7°–8° long, with stout ultimate divisions; flowers in Texas appearing in March or April in the axils of persistent bracts half as long as the perianth. **Fruit** ripening early in the summer, globose, often 2 or 3-lobed; **seeds** nearly ½′ broad and ¼′ wide, dark chestnut-brown, with a broad shallow basal cavity, and a conspicuous orange-colored hilum.

A tree, with a trunk 30°–50° high, often 2½° in diameter, and a broad head of erect ultimately pendulous leaves. **Wood** light, soft, pale brown tinged with red, with thick light-colored rather inconspicuous fibro-vascular bundles, the outer rim 1′ thick, soft, and light colored. On the Gulf coast the trunks are used for wharf-piles, and on the lower Rio Grande the leaves for the thatch of houses.

Distribution. Rich soil of the bottom-lands on the Bernado River, Cameron County, and near the mouth of the Rio Grande, Texas, and southward in Mexico in the neighborhood of the coast.

Frequently planted as a street tree in the towns in the lower Rio Grande valley.

4. WASHINGTONIA H. Wendl.

Trees, with stout columnar stems and broad crowns of erect and spreading finally pendulous leaves. Leaves flabellate, divided nearly to the middle into many narrow deeply parted recurved segments separating on the margins into numerous slender pale fibres; rachis short, slightly rounded on the back, gradually narrowed from a broad base, with concave margins furnished below with narrow erect wings, and slender and acute above; ligule elongated, oblong, thin and laciniate on the margins; petioles elongated, broad and thin, flattened or slightly concave on the upper side, rounded on the lower, armed irregularly with broad thin large and small straight or hooked spines confluent into a thin bright orange-colored cartilaginous margin, gradually enlarged at base into thick broad concave bright chestnut-brown sheaths composed of a network of thin strong fibres. Spadix interfoliar, stalked, elongated, paniculate, with pendulous flower-bearing ultimate divisions and numerous long spathes. Flowers perfect, jointed on thick disk-like pedicels; calyx tubular, scarious, thickened at base, gradually enlarged and slightly lobed at apex, the lobes imbricated in the bud; corolla funnel-formed, with a fleshy tube inclosed in the calyx and about half as long as the lanceolate lobes thickened and glandular on the inner surface at the base, imbricated in the bud; stamens inserted on the tube of the corolla, with free filaments thickened near the middle and linear-oblong anthers; ovary 3-lobed, 3-celled, with slender elongated flexuose styles stigmatic at apex; ovules lateral, erect. Fruit a small ellipsoidal short-stalked black berry with thin dry flesh. Seed free, erect, oblong-ovoid, concave above, with a flat base depressed in the centre, a minute sublateral hilum, a broad conspicuous rachis, a minute lateral micropyle, and a thin pale chestnut-brown inner coat closely investing the simple horny albumen; embryo minute, lateral, with the radicle turned toward the base of the fruit.

Three species of Washingtonia are known: one inhabits the interior dry region of southern California and the adjacent parts of Lower California, and the others the mountain cañons of western Sonora and southern Lower California.

The genus is named for George Washington.

1. **Washingtonia filamentosa** O. Kuntze. **Desert Palm. Fan Palm.**

Leaves 5°–6° long and 4°–5° wide, light green, slightly tomentose on the folds; petioles

Fig. 101

4°–6° long and about 2′ broad at apex, with sheaths 16′–18′ long and 12′–14′ wide, and ligules 4′ long and cut irregularly into long narrow lobes. **Flowers:** spadix 10°–12° long, 3 or 4 being produced each year from the axils of upper leaves, the outer spathe inclosing the bud, narrow, elongated, and glabrous, those of the secondary branches coriaceous, yellow tinged with brown, and laciniate at apex; flowers slightly fragrant, opening late in May or early in June. **Fruit** produced in great profusion, ripening in September, $\frac{1}{3}$′ long; **seed** $\frac{1}{4}$′ long, $\frac{1}{8}$′ thick.

A tree, occasionally 75° high, with a trunk sometimes 50°–60° tall and 2°–3° in diameter, covered with a thick light red-brown scaly rind and clothed with a thick thatch of dead pendant leaves descending in a regular cone from the broad crown of living leaves sometimes nearly to the ground. **Wood** light and soft, with numerous conspicuous dark orange-colored fibro-vascular bundles. The fruit is gathered and used as food by the Indians.

Distribution. Often forming extensive groves or small isolated clumps in wet usually alkali soil in depressions along the northern and northwestern margins of the Colorado Desert in southern California, sometimes extending for several miles up the cañons of the San Bernardino and San Jacinto mountains; and in Lower California.

Now largely cultivated in southern California, New Orleans, southern Europe, and other temperate regions.

5. ACŒLORRAPHE H. Wendl.

Paurotia Cooke.

Trees, with tall slender often clustered stems clothed for many years with the sheathing bases of the petioles of fallen leaves. **Leaves** suborbicular, divided into numerous two-parted segments plicately folded at the base; rachis short, acute; ligule thin, concave, furnished with a broad membranaceous dark red-brown deciduous border; petioles slender, flat or slightly concave on the upper side, rounded and ridged on the lower side, with a broad high rounded ridge, thickened and cartilaginous on the margins, more or less furnished with stout or slender flattened teeth; vagina thin and firm, bright mahogany red, lustrous, closely infolding the stem, its fibres thin and tough. Spadix paniculate, interpetiolar, its rachis slender, compressed, ultimate branches, numerous, slender, elongated, gracefully drooping, hoary-tomentose, the primary branches flattened, the secondary terete in the axils of ovate acute chestnut-brown bracts; spathes flattened, thick and firm, deeply two-cleft and furnished at apex with a red-brown membranaceous border, inclosing the rachis of the panicle, each primary branch with its spathe and the node of the rachis below it inclosed in a separate spathe, the whole surrounded by the larger spathe of the node next below. Flowers perfect, minute, sessile on the ultimate branches of the spadix, in the axils of ovate acute chestnut-brown caducous bracts, solitary toward the end of the branches and in two- or three-flowered clusters near their base; calyx truncate at base, divided into three broadly ovate sepals dentate on the margins, valvate in æstivation, enlarged and persistent under the fruit; corolla three-parted nearly to the base, its divisions valvate in æstivation, oblong-ovate, thick, concave and thickened at apex, deciduous; stamens six, included; filaments nearly triangular, united below into a cup adnate to the short tube of the corolla; anthers short-oblong, attached on the back below the middle, introrse, two-celled, the cells opening longitudinally; ovary obovoid, of three carpels, each with two deep depressions on their outer face, united into a slender style; stigma minute, terminal, persistent on the fruit; ovule solitary, erect from the bottom of the cell, anatropous. Fruit drupaceous, subglobose, one-seeded, black and lustrous; exocarp thin and fleshy; endocarp thin, crustaceous; seed erect, free, subglobose, light chestnut-brown; testa thin and hard; hilum small, suborbicular; raphe ventral, oblong, elongated, black, slightly prominent, without ramifications; embryo lateral; albumen homogeneous.

Two species of Acœlorraphe have been distinguished; they inhabit southern Florida, and one species occurs also in Cuba and on the Bahama Islands.

The generic name, from ἀ priv., κοῖλος and ῥαφή, refers to the character of the seed.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Petioles furnished with stout marginal teeth throughout their entire length; leaves green on both surfaces, their primary divisions extending to the middle, secondary divisions only from $3\frac{1}{2}'$–$9'$ long; stems forming large thickets. 1. **A. Wrightii** (D).

Petioles furnished with thinner teeth, usually unarmed toward the apex; leaves green or glaucescent on the lower surface, their primary divisions extending nearly to the base, secondary divisions often 10′ long or more; stems often prostrate. 2. **A. arborescens** (D).

1. Acœlorraphe Wrightii Becc.

Paurotia Wrightii Britt.

Leaves 30′–36′ in diameter, thin, light green, divided only to the middle, the divisions of the primary lobes $3\frac{1}{2}'$–$9'$ long; petioles thin, gradually tapering from the base, 40′–60′

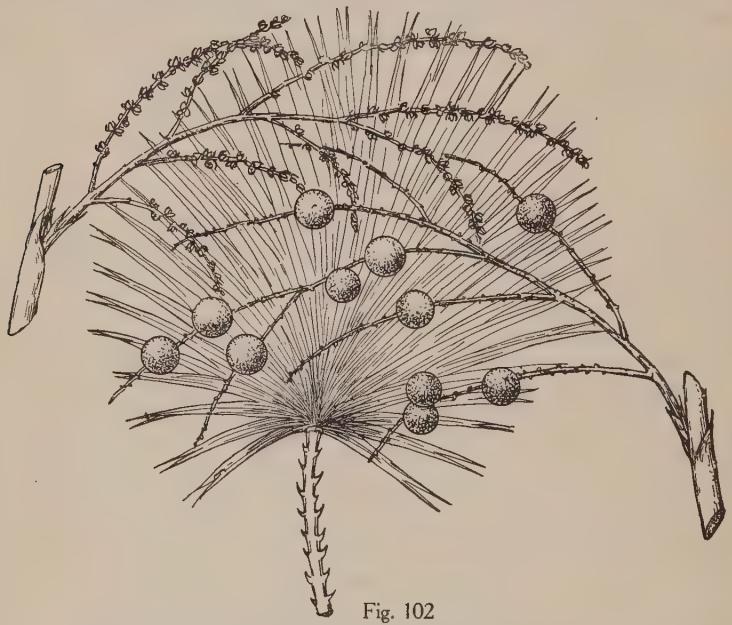

Fig. 102

in length, armed throughout with stout straight or incurved teeth. **Flowers:** spadix 4°–6° long; flowers $\frac{1}{8}'$–$\frac{1}{6}'$ long, with a light chestnut-brown calyx and a pale yellow-green corolla. **Fruit** $\frac{1}{4}'$ in diameter.

A tree with numerous stems, in Florida sometimes 10 metres high, forming great thickets.

Distribution. Dade County, Florida, from the rear of Madeira Hummock to Cape Sable, in swamps of fresh or brackish water at some distance from the coast; also in Cuba and on the Bahamas.

2. Acœlorraphe arborescens Becc.

Serenoa arborescens Sarg.

Leaves about 2° in diameter, light yellow-green on the upper surface, blue-green or glaucescent on the lower surface, divided nearly to the base into numerous lobes slightly thickened at the pale yellow midribs and margins; petioles 18′–24′ long, armed, except toward the apex, with stout flattened curved orange-colored teeth. **Flowers:** spadix

3°–4° long, with a slender much-flattened stalk, panicled lower branches 18′–20′ in length, and 6–8 thick firm pale green conspicuously ribbed spathes dilated at apex into a narrow border; flowers with a light chestnut-brown calyx and a pale yellow-green corolla. **Fruit** globose, ½′ in diameter; **seed** somewhat flattened below, with a pale vertical mark on the lower side, and a hilum joined to the micropyle by a pale band.

A tree, from 30°–40° high, with 1 or several clustered erect inclining or occasionally semi-prostrate stems 3′–4′ in diameter, covered almost to the ground by the closely clasping bases of the leaf-stalks and below with a thick pale rind.

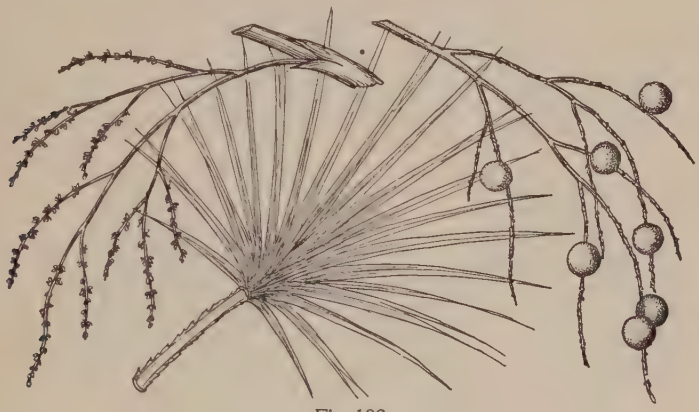

Fig. 103

Distribution. Low undrained soil covered for many months of every year in water from 1′–18′ deep, occasionally occupying almost exclusively areas of several acres in extent or more often scattered among Cypress-trees or Royal Palms, in the swamps and along the hummocks adjacent to the Chokoloskee River and its tributaries and at the head of East River, Whitewater Bay, in southwestern Florida.

6. ROYSTONEA Cook. Royal Palm.

Unarmed trees, with massive stems enlarged near the middle, and terminating in long slender bright green cylinders formed by the closely appressed sheath of the lowest leaf Leaves equally pinnate, with linear-lanceolate long-pointed unequally cleft plicately-folded pinnæ inserted obliquely on the upper side of the rachis, folded together at the base, with thin midribs and margins; rachis convex on the back, broad toward the base of the leaf and acute toward its apex; petioles semicylindric, gradually enlarged into thick elongated green sheaths. Spadix large, decompound, produced near the base of the green part of the stem, with long pendulous branches and 2 spathes, the outer semicylindric and as long as the spadix, the inner splitting ventrally and inclosing the branches of the spadix. Flowers monœcious, in a loose spiral, toward the base of the branch in 3-flowered clusters, with a central staminate and smaller lateral pistillate flowers, higher on the branch the staminate in 2-flowered clusters; calyx of the staminate flower of minute broadly ovate obtuse scarious sepals imbricated in the bud, much shorter than the corolla; petals nearly equal, valvate in the bud, ovate or obovate, acute, slightly united at the base, coriaceous; stamens 6, 9, or 12, with subulate filaments united below and adnate to the base of the corolla, and large ovate-sagittate anthers, the cells free below; ovary rudimentary, subglobose or 3-lobed; pistillate flowers much smaller, ovoid-conic; sepals obtuse; corolla erect, divided to the middle into acute erect lobes incurved at apex; staminodia 6, scale-like, united into a cup adnate to the corolla; ovary subglobose, obscurely 2 or 3-lobed,

2 or 3-celled, gibbous, the cells crowned with a 3-lobed stigma becoming subbasilar on the fruit; ovule ascending. Fruit a short-stalked drupe with thin crustaceous flesh. Seed oblong-reniform, marked by the conspicuous fibrous reticulate branches of the raphe radiating from the narrow basal hilum, and covered with a thin crustaceous coat; embryo minute, cylindric, lateral, in uniform albumen.

Roystonea is confined to the tropics of the New World, where two or three species occur. The genus as here limited was named for General Roy Stone of the United States army.

1. Roystonea regia Cook. Royal Palm.

Oreodoxa regia H. B. K.

Leaves 10°–12° long, closely pinnate, the pinnæ, 2½°–3° long, 1½′ wide near the base of the leaf, and gradually decreasing in size toward its apex, deep green with slender conspicuous veins, and covered below with minute pale glandular dots; petioles almost terete, concave near the base, with thin edges separating irregularly into pale fibres, and enlarged

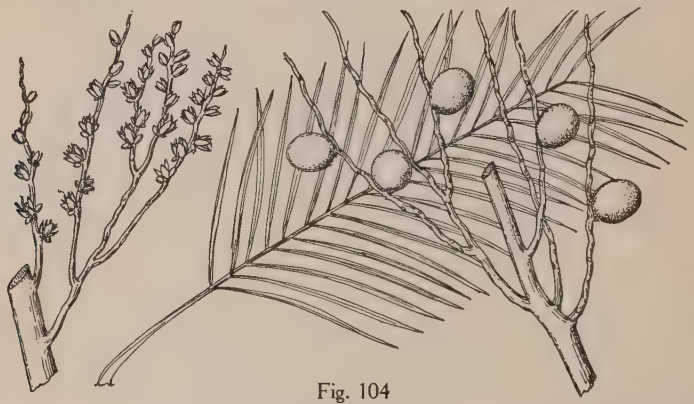

Fig. 104

into bright green cylindrical clasping bases 8° or 9° long and more or less covered with dark chaffy scales. **Flowers**: spadix about 2° long, with a nearly terete stem and slightly ridged primary and secondary branches compressed above, abruptly enlarged at the base, and simple slender flexuose long-pointed flower-bearing branchlets 3′–6′ long, pendant and closely pressed against the secondary branches; flowers opening in Florida in January and February, the staminate nearly ¼′ long and rather more than twice as long as the pistillate. **Fruit** oblong-obovoid, full and rounded at apex, narrowed at base, violet-blue, about ½′ long, with a thin outer coat and a light red-brown inner coat, loose and fibrous on the outer surface, and closely investing the thin light brown seed.

A tree, 80°–100° high, with a trunk rising from an abruptly enlarged base, gradually tapering from the middle to the ends and often 2° in diameter, covered with light gray rind tinged with orange color, marked with dark blotches and irregularly broken into minute plates, the green upper portion 8°–10° long, and a broad head of gracefully drooping leaves. **Wood** of the interior of the stem spongy, pale brown, much lighter than the hard exterior rim, containing numerous dark conspicuous fibro-vascular bundles. The outer portion of the stem is made into canes, and the trunks are sometimes used for wharf-piles and in construction.

Distribution. Florida, hummocks on Rogue River twenty miles east of Caximbas Bay, on some of the Everglades Keys, Long's Key, and formerly on the shores of Bay Biscayne near the mouth of Little River; common in the West Indies and Central America.

Largely cultivated as an ornamental tree in tropical countries, and often planted to form avenues, for which its tall pale columnar stems and noble heads of graceful foliage make it valuable.

7. PSEUDOPHŒNIX H. Wendl.

A tree, with a slender stem abruptly enlarged at the base or tapering from the middle to the ends, covered with thin pale blue or nearly white rind, and conspicuously marked by the dark scars of fallen leaf-stalks. Leaves erect, abruptly pinnate, with crowded linear-lanceolate acuminate leaflets increasing in length and width from the ends to the middle of the leaf, thick and firm in texture, dark yellow-green above, pale and glaucous below; rachis convex on the lower side, concave on the upper side near the base of the leaf, with thin margins, becoming toward the apex of the leaf flat and narrowed below and acute above, marked on the sides at the base with dark gland-like excrescences; petioles short, concave above, with thin entire margins separating into slender fibres, gradually enlarged into broad thick sheaths of short brittle fibres. Spadix interfoliar, compound, pendulous, stalked, much shorter than the leaves, with spreading primary branches, stout and much flattened toward the base, slender and rounded above the middle, furnished at the base with a thickened ear-like body, slender secondary branches, short thin rigid densely flowered ultimate divisions, and compressed light green double spathes erose on their thin dark brown margins. Flowers on slender pedicels articulate by an expanded base, widely scattered on the ultimate branches of the spadix, staminate and bisexual in the same inflorescence; calyx reduced to the saucer-like rim of the thickened receptacle, undulate on the margin, the rounded angles alternating with the petals; petals 3, valvate in the bud, oblong, rounded at apex, thick conspicuously longitudinally veined, persistent; stamens 6, with short flattened nearly triangular filaments slightly united at the base into a narrow fleshy disk, and triangular cordate anthers attached at the base in a cavity on their outer face, 2-celled, the cells opening by lateral slits; styles of the perfect flower 3-lobed at the apex with obtuse appressed lobes, that of the sterile flower as long or longer than that of the perfect flower, more slender and tapering into a narrow 3-pointed apex. Fruit a stalked globose 2 or 3-lobed orange-scarlet thin-fleshed drupe marked by the lateral style and surrounded below by the withered remnants of the flower; pedicel abruptly enlarged at base, articulate from a persistent cushion-like body furnished in the centre with a minute point penetrating a cavity in the base of the pedicel. Seed subglobose, free, erect, with a basal hilum and a thin light red-brown coat marked by the pale conspicuous ascending 2 or 3-branched raphe; embryo minute, basal, in uniform horny albumen.

Pseudophœnix with a single species inhabits the keys of southern Florida, and the Bahamas.

The generic name is in allusion to a fancied resemblance to *Phœnix*, a genus of Palms.

1. Pseudophœnix vinifera Becc.

Leaves 5°–6° long, with pinnæ often 18′ long and 1′ wide near the middle of the leaf,

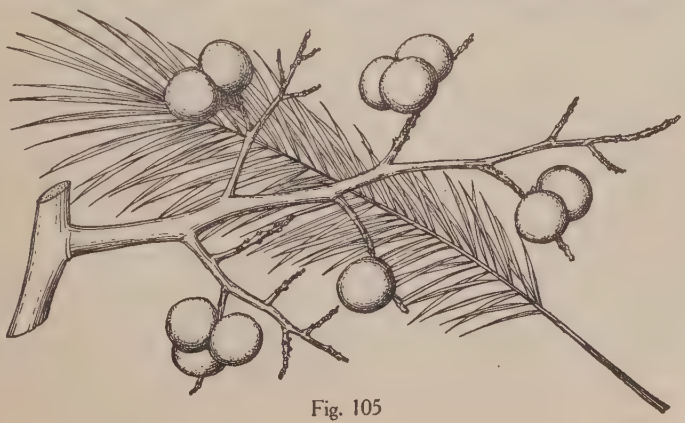

Fig. 105

becoming at its extremities not more than half as long and wide; petioles 6′–8′ in length. **Flowers**: spadix 3° long and 2½° wide. **Fruit** ripening in May and June, ½′–¾′ in diameter on a peduncle ¼′ long; **seed** ¼′ in diameter.

Distribution. Florida, east end of Elliot's Key, and east end of Key Largo near the southern shore, here forming a grove of 200 or 300 plants; more common on the Bahamas.

Occasionally cultivated in the gardens of southern Florida.

IV. LILIACEÆ.

YUCCÆ.

Leaves, alternate, linear-lanceolate. Flowers in terminal panicles; sepals and petals nearly similar, subequal, withering-persistent; ovary with more or less deeply introduced dorsal partitions; ovules numerous, 2-ranked in each cell; embryo subulate, obliquely placed across the seed; cotyledon arched in germination.

Yuccæ as here limited consists of two American genera, Hesperaloe, with two species, low plants of Texas and Mexico, and Yucca.

1. YUCCA L.

Trees with simple or branched stems prolonged by axillary naked buds, dark thick corky bark, light fibrous wood in concentric layers, and large stout horizontal roots; or often stemless. Leaves involute in the bud, at first erect, usually becoming reflexed, abruptly narrowed above the broad thickened clasping base, usually widest near the middle, concave on the upper surface, involute toward the horny usually sharp-pointed apex, convex and often slightly keeled toward the base on the lower surface, the margins serrulate or filamentose, light or dull green. Flowers fertilized by insects and opening for a single night, on slender pedicels in 2 or 3-flowered clusters or singly at the base of the large compound panicle furnished with conspicuous leathery white or slightly colored bracts, those at the base of the pedicels thin and scarious; perianth cup-shaped, with thick ovate-lanceolate creamy white segments more or less united at base, usually furnished with small tufts of white hairs at the apex, those of the outer rank narrower, shorter, and more colored than the more delicate petal-like segments of the inner rank; stamens 6, in 2 series, free, shorter than the ovary (*as long in* 1), white, with club-shaped fleshy filaments, obtuse and slightly 3-lobed at the apex, and cordate emarginate anthers attached on the back, the cells opening longitudinally, curling backward and expelling the large globose powdery pollen-grains; ovary oblong, 6-sided, sessile or stalked, with nectar-glands within the partitions, dull greenish white, 3-celled, gradually narrowed into a short or elongated 3-lobed ivory-white style forming a triangular stigmatic tube. Fruit oblong or oval, more or less distinctly 6-angled, 6-celled, usually beaked at the apex, baccate and indehiscent or capsular and 3-valved, the valves finally separating at the apex; pericarp of 2 coats, the outer at maturity thick, succulent and juicy, thin, dry and leathery, or thin and woody. Seeds compressed, triangular, obovoid, or obliquely ovoid or orbicular, thick, with a narrow 2-edged rim, or thin, with a wide or narrow brittle margin; seed-coat thin, black, slightly rugose or smooth; embryo in plain or rarely ruminate hard farinaceous oily albumen; cotyledon much longer than the short radicle turned toward the small oblong white hilum.

Yucca is confined to the New World and is distributed from Bermuda and the eastern Antilles, through the south Atlantic and Gulf states to Oklahoma and Arkansas, and through New Mexico and northward along the eastern base of the Rocky Mountains to South Dakota, westward to middle California, and southward through Arizona, Mexico, and Lower California to Central America. About thirty species with many varieties and probable hybrids are recognized. Of the species which inhabit the territory of the United States nine assume the habit and attain the size of small trees. The root-stalks of Yucca are used as a substitute for soap, and ropes, baskets, and mats are made from the tough fibres of the leaves. Many of the species are cultivated, especially in countries of scanty rainfall, for their great clusters of beautiful flowers, or in hedges to protect gardens from cattle.

The generic name is from the Carib name of the root of the Cassava.

CONSPECTUS OF THE ARBORESCENT SPECIES OF THE UNITED STATES.

Flower-clusters usually sessile, or short-stalked.
Fruit pendulous, with thick succulent flesh; seeds thick; albumen ruminate.
Segments of the perianth slightly united at the base.
Panicle glabrous or puberulous.
Ovary stipitate; leaves sharply toothed on their horny margins, smooth, dark green, slightly concave. 1. **Y. aloifolia** (C).
Ovary sessile.
Leaves concave, blue-green, rough on the lower surface. 2. **Y. Treculeana** (E).
Leaves concave above the middle, light yellow-green, smooth.
Style elongated. 3. **Y. macrocarpa** (E, H).
Style short. 4. **Y. mohavensis** (G, H).
Panicle coated with hoary tomentum; leaves concave, smooth, light yellow-green. 5. **Y. Schottii** (H).
Segments of the perianth united below into a narrow tube; leaves flat, smooth, dark green. 6. **Y. Faxoniana** (E).
Fruit erect or spreading, the flesh becoming thin and dry at maturity; seeds thin; albumen entire.
Leaves rigid, concave above the middle, blue-green, sharply serrate. 7. **Y. brevifolia** (F, G).
Leaves thin, flat or concave toward the apex, nearly entire, rough on the lower surface, dull or glaucous green. 8. **Y. gloriosa** (C).
Flower-clusters long-stalked; fruit capsular, erect, finally splitting between the carpels and through their backs at the apex; seeds thin; albumen entire; leaves thin, flat, filamentose on the margins, smooth, pale yellow-green. 9. **Y. elata** (E, H).

1. Yucca aloifolia L. Spanish Bayonet.

Leaves 18′–32′ long, $1\frac{1}{4}$′–$2\frac{1}{2}$′ wide, erect, rigid, conspicuously narrowed above the light green base, widest above the middle, slightly concave on the upper surface, smooth, dark

Fig. 106

rich green, with a stiff dark red-brown tip, and horny finely and irregularly serrate margins; long-persistent. **Flowers** from June until August on stout pedicels, in nearly sessile glabrous or slightly pubescent panicles 18′–24′ long; perianth 1′–$1\frac{1}{2}$′ in length and 3′ or 4′ across when fully expanded, the segments ovate, thick and tumid toward the base, those of the outer rank rounded and often marked with purple at apex, the inner acuminate

and short-pointed; stamens as long or sometimes a little longer than the light green ovary raised on a short stout stipe. **Fruit** ripening from August to October, elongated, ellipsoidal, hexagonal, 3′–4′ long, 1¼′–1½′ thick, light green when fully grown, and in ripening turning dark purple, the outer and inner coats forming a thick succulent mass of bitter-sweet juicy flesh, finally becoming black and drying on its stalk; **seeds** ¼′–⅓′ wide, about $\frac{1}{16}$′ thick, with a thin narrow ring-like border to the rim.

A tree, occasionally 25° high, usually much smaller, with an erect or more or less inclining simple or branched trunk slightly swollen at base, and rarely more than 6′ in diameter; sometimes with numerous clustered stems. **Bark** near the base of the trunk thick, rough, dark brown, marked above by scars left by falling leaves.

Distribution. Sand dunes of the coast from North Carolina to eastern Louisiana; west of the Apalachicola River attaining its largest size and sometimes ranging inland through Pine-forests for thirty or forty miles; and in Yucatan (var. **yucatana** Trel.).

A common garden plant in all countries with a temperate climate, and long naturalized in the southern states far beyond the limits of its natural range, in some of the West Indian islands and on the Gulf coast of Mexico. Forms with leaves variously striped with white, yellow, and red or with recurving leaves are frequent in cultivation.

2. Yucca Treculeana Carr. Spanish Bayonet. Spanish Dagger.

Leaves 2½°–4° long, 2′–3¼′ wide, slightly or not at all contracted above the dark red lustrous base, concave, stiff, rigid, dark blue-green, rough on the lower surface, nearly smooth on the upper, with a short stout dark red-brown tip, and dark brown margins roughened by minute deciduous teeth and ultimately separating into slender dark fibres;

Fig. 107

persistent for many years, the dead leaves hanging closely appressed against the trunk below the terminal crown of closely imbricated living leaves. **Flowers** in March and April on slender pedicels, in dense many-flowered glabrous or puberulous panicles 2°–4° long and raised on short stout stalks; perianth 1′–2′ long, 2′–4′ in diameter when fully expanded, with narrow elongated ovate-lanceolate to ovate segments, ¼′ wide, acute, thin and delicate, furnished at apex with a conspicuous tuft of short pale hairs; filaments slightly papillose, about as long as the prismatic ovary gradually narrowed above and crowned by the deeply divided stigmatic lobes. **Fruit** ripening in the summer, 3′–4′ long, about 1′ thick, dark reddish brown or ultimately black, with thin succulent sweetish flesh; **seeds** about ⅛′ wide, nearly $\frac{1}{16}$′ thick, with a narrow border to the rim.

A tree, occasionally 25°–30° high, with a trunk sometimes 2° in diameter and numerous stout wide-spreading branches; usually smaller and often forming broad low thickets 4°–

5° tall. **Bark** on old trunks ¼′–½′ thick, dark red-brown and broken into thin oblong plates covered by small irregular closely appressed scales. **Wood** light brown, fibrous, spongy, heavy, difficult to cut and work.

Distribution. Shores of Matagorda Bay, southward through western Texas into Nuovo Leon, and through the valley of the Rio Grande to the eastern base of the mountains of western Texas; forming open stunted forests on the coast dunes at the mouth of the Rio Grande; farther from the coast often spreading into great impenetrable thickets.

Cultivated as an ornamental plant in the gardens of central and western Texas and in other southern States, and occasionally in those of southern Europe.

3. Yucca macrocarpa Coville. Spanish Dagger.

Leaves 1½°–2° long, 1′–2′ wide, gradually narrowed from the dark red lustrous base to above the middle, rigid, concave, yellow-green, rough on the lower surface and frequently also on the upper surface, with a stout elongated dark tip, and thickened margins sep-

Fig. 108

arated into stout gray filaments. **Flowers** in March and April in densely flowered sessile or short-stalked glabrous or occasionally pubescent panicles; perianth usually about 2′ long, with acuminate segments, those of the outer and inner rows nearly of the same size; stamens shorter than the elongated style. **Fruit** 3′–4′ long, about 1½′ thick, abruptly contracted at apex into a stout point, nearly black when fully ripe, with sweet succulent flesh; **seeds** about ⅓′ wide, ⅛′ thick, with a narrow border to the rim.

A tree, rarely exceeding 15° in height, with a usually simple stem 6′–8′ in diameter, and often clothed to the ground with living leaves. **Bark** dark brown and scaly.

Distribution. Arid plains from western Texas to eastern Arizona and southward in Chihuahua.

4. Yucca mohavensis Sarg. Spanish Dagger.

Leaves 18′–20′ long, about 1½′ wide, abruptly contracted above the dark red lustrous base, gradually narrowed upward to above the middle, thin and concave except toward the slightly thickened base of the blade, dark green, smooth on both surfaces, with a stout rigid sharp-pointed tip, and entire bright red-brown margins soon separating into numerous pale filaments. **Flowers** from March to May on slender erect ultimately drooping pedicels 1′–1½′ long, in densely flowered sessile or short-stemmed panicles 12′–18′ in length; perianth 1′–2′ long, the segments united at the base into a short tube, thickened and hood-shaped at the apex, those of the outer rank often deeply flushed with purple, but little longer than the less prominently ribbed usually wider and thinner segments of the inner rank; stamens

with more or less pilose filaments nearly as long as the short style. **Fruit** ripening in August and September, 3′–4′ long, about 1½′ thick, usually much constricted near the middle,

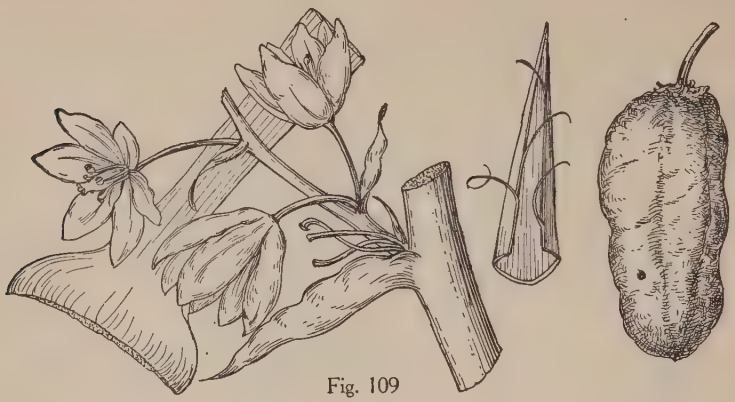

Fig. 109

abruptly contracted at apex into a short stout point, dark dull brown or nearly black, with flesh often nearly ½′ thick; **seeds** ⅓′ wide, rather less than ⅛′ thick, with a narrow border to the rim.

A tree, rarely exceeding 15° in height, with a trunk usually simple or occasionally furnished with short spreading branches, and 6′–8′ in diameter, usually surrounded by a cluster of shorter more or less spreading stems and often clothed to the ground with living leaves. **Bark** dark brown and scaly. **Wood** soft, spongy, light brown.

Distribution. Southern Nevada and northwestern Arizona across the Mohave Desert to the California coast, extending northward to the neighborhood of Monterey, California, and southward into northern Lower California; common and attaining its largest size on the Mohave Desert, and sometimes ascending arid mountain slopes to altitudes of 4000° above the sea.

5. Yucca Schottii Engelm. Spanish Dagger.

Leaves 2½°–3° long, about 1½′ wide, gradually narrowed upward from the comparatively thin lustrous red base to above the middle, flat except toward the apex, smooth, light

Fig. 110

yellow-green, with a long rigid sharp light red tip, and thick entire red-brown margins finally separating into short thin brittle threads. **Flowers** from July to September in erect stalked tomentose panicles; perianth 1′–1¾′ long, the broad oval or oblong-obovate thin segments pubescent on the outer surface toward the base and furnished at the apex with conspicuous clusters of white tomentum; stamens about two thirds as long as the ovary, with filaments pilose at the base, and only slightly enlarged at the apex. **Fruit** ripening in October and November, obscurely angled, 3½′–4′ long, about 1¼′ thick, often narrowed above the middle, with a stout thick point, and thin succulent flesh; **seeds** ¼′ wide, about ⅛′ thick, with a thin conspicuous marginal rim.

A tree, in Arizona rarely 18°–20° high, with a trunk often crooked or slightly inclining and simple or furnished with 2 or 3 short erect branches, covered below with dark brown scaly bark, roughened for many years by persistent scars of fallen leaves, and clothed above by the pendant dead leaves of many seasons.

Distribution. Dry slopes of the mountain ranges of Arizona near the Mexican boundary usually at altitudes between 5000° and 6000°, and southward into Sonora.

6. Yucca Faxoniana Sarg. Spanish Dagger.

Leaves 2½°–4° long, 2½′–3′ wide, abruptly contracted above the conspicuously thickened lustrous base, widest above the middle, flat on the upper surface, thickened and rounded on the lower surface toward the base, rigid, smooth and clear dark green, with a short stout

Fig. 111

dark tip, and brown entire margins breaking into numerous stout gray or brown fibres short and spreading near the apex of the leaf, longer, more remote, and forming a thick cobweb-like mass at their base. **Flowers** appearing in April on thin drooping pedicels, in dense many-flowered glabrous panicles 3°–4° long, with elongated pendulous branches; perianth 2½′ long, the segments thin, concave, widest above the middle, narrowed at the ends, united at base into a short tube, those of the outer rank being about half as wide as those of the inner rank and two thirds as long; stamens much shorter than the ovary, with slender filaments pilose above the middle and abruptly dilated at apex; ovary conspicuously ridged, light yellow marked with large pale raised lenticels, and gradually narrowed into an elongated slender style. **Fruit** ripening in early summer, slightly or not at all angled, abruptly contracted at apex into a long or short hooked beak, 3′–4′ long, 1′–1½′ thick, light orange-colored and lustrous when first ripe, becoming nearly black, with thick succulent bitter-sweet flesh; **seeds** ¼′ long, about ⅛′ thick, with a narrow nearly obsolete margin to the rim.

A tree, often 40° high, with a trunk sometimes 2° in diameter above the broad abruptly

enlarged base, unbranched or divided into several short branches, and covered above by a thick thatch of the pendant dead leaves of many seasons; frequently smaller and until ten or twelve years old clothed from the ground with erect living leaves. **Bark** near the base of old trees dark reddish brown, $\frac{1}{3}'$–$\frac{1}{2}'$ thick, broken on the surface into small thin loose scales.

Distribution. Common on the high desert plateau of southwestern Texas.

7. Yucca brevifolia Engelm. Joshua Tree.

Yucca arborescens Trel.

Leaves 5′–8′ or on young plants rarely 10′–12′ long, $\frac{1}{4}'$–$\frac{1}{2}'$ wide, rigid, crowded in dense clusters, lanceolate, gradually tapering from the bright red-brown lustrous base, bluish green and glaucous, smooth or slightly roughened, concave above the middle, with a sharp dark brown tip, and thin yellow margins armed with sharp minute teeth; persistent

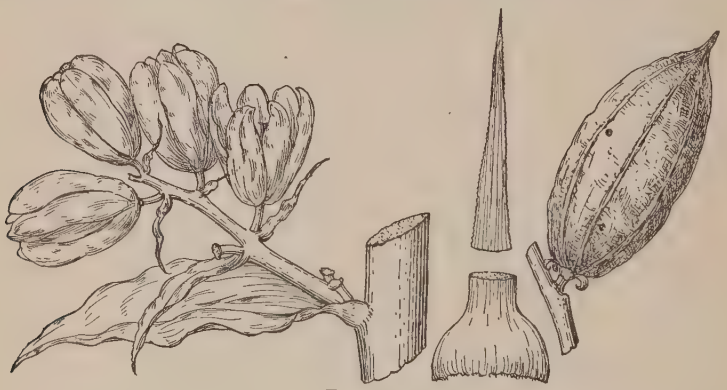

Fig. 112

for many years. **Flowers** appearing from March until the beginning of May, the creamy white closely imbricated bracts of the nearly sessile pubescent panicle forming before its appearance a conspicuous cone-like bud 8′ or 10′ long; perianth globose to oblong, 1′–2′ long, greenish white, waxy, dull or lustrous, its segments slightly united at the base, keeled on the back, thin below the middle, gradually thickened upward into the concave incurved rounded tip, those of the outer rank rather broader, thicker, and more prominently keeled than those of the inner rank, glabrous or pubescent; stamens about half as long as the ovary, with filaments villose-papillate from the base; ovary conic, 3-lobed above the middle, bright green, with narrow slightly developed septal nectar-glands, and a sessile nearly equally 6-lobed stigma. **Fruit** ripening in May or June, spreading or more or less pendant at maturity, oblong-ovoid, acute, slightly 3-angled, 2′–4′ long, $1\frac{1}{2}'$–2′ thick, light red or yellow-brown, the outer coat becoming dry and spongy at maturity; **seeds** nearly $\frac{1}{2}'$ long, rather less than $\frac{1}{16}'$ thick, with a broad well-developed margin to the rim, and a large conspicuous hilum.

A tree, 70°–60° high, with a trunk 2°–3° in diameter, rising abruptly from a broad thick basal disk, thick tough roots descending deeply into the soil, and stout branches spreading into a broad, often symmetrical head formed by the continued forking of the branches at the base of the terminal flower-clusters; the stem until 8°–10° high simple and clothed to the ground with leaves erect until after the appearance of the first flowers, then spreading at right angles and finally becoming reflexed. **Bark** 1′–$1\frac{1}{2}'$ thick, deeply divided into oblong plates frequently 2° long. **Wood** light, soft, spongy, difficult to work, light brown or nearly white; sometimes cut into thin layers and used as wrapping material or manufactured into boxes and other small articles. The seeds are gathered and eaten by Indians.

Distribution. Southwestern Utah to the western and northern rim of the Mohave Desert in California; most abundant and of its largest size on the foothills on the desert slope of the Tehachapi Mountains, California.

8. Yucca gloriosa L. Spanish Dagger.

Leaves 2°–2½° long, gradually narrowed above the broad base and then gradually broadened to above the middle, thin, flat or slightly concave toward the apex, frequently longitudinally folded, dull often glaucous green, roughened on the under surface especially above the middle, with a stout dark red tip, and pale margins serrulate toward the base of the leaf, with minute early deciduous teeth, or occasionally separating into thin fibres. **Flowers** in October, in pubescent or glabrate panicles, 2°–4° long, on stout stalks sometimes

Fig. 113

3°–4° in length, their large creamy white bracts forming before the panicle emerges a conspicuous egg-shaped bud 4′–6′ long; perianth when fully expanded 3½′–4′ across, its segments thin, ovate, acute, or lance-ovate, often tinged with green or purple, slightly united at the base, pubescent at apex; stamens about as long as the ovary, with hispid or slightly papillose filaments and deeply emarginate anthers; ovary slightly lobed, 6-sided, light green, gradually narrowed into the elongated spreading stigmatic lobes. **Fruit** very rarely produced, prominently 6-ridged, pendulous, 3′ long, 1′ in diameter, cuspidate, raised on a short stout stipe, with a thin leathery almost black outer coat; **seeds** ¼′ wide and about $\frac{1}{30}$′ thick, with a smooth coat and a narrow marginal rim.

A tree, with a trunk occasionally 6°–8° high and 4′–6′ in diameter, simple or rarely furnished with a few short branches and usually clothed to the base with pendant dead leaves; in cultivation often becoming much larger, with a stout trunk covered with smooth light gray bark, and erect or in one form (var. *recurvifolia* Engelm.) pendulous leaves.

Distribution. Sand dunes and the borders of beaches of the seacoast from North Carolina to northern Florida.

Often cultivated with many forms in the gardens and pleasure-grounds of all temperate countries.

9. Yucca elata Engelm. Spanish Dagger.

1. *Yucca radiosa* Trel.

Leaves 20′–30′ long, ¼′–½′ wide, rigid, gradually narrowed from the thin base, tapering toward the apex, or sometimes somewhat broadest at the middle, thin, flat on the upper surface, slightly thickened and rounded on the lower surface toward the base, smooth, pale

yellow-green, with a slender stiff red-brown tip, and thickened entire pale margins soon splitting into long slender filaments. **Flowers** in May and June on slender spreading more or less recurved pedicels, in glabrous much-branched panicles 4°–6° long, raised on stout naked stem 3°–7° in length; perianth ovoid and acute in the bud, when fully expanded 3½′–4′ across, its segments united at the base into a short slender distinct tube, ovate or slightly obovate, those of the outer rank usually acute, not more than half as broad as those of the inner rank; stamens as long or a little longer than the ovary, with slender nearly terete filaments; ovary sessile, almost terete, pale green, abruptly contracted into the stout elongated style. **Fruit** an erect oblong capsule rounded and obtuse at the ends, tipped by a short stout mucro, conspicuously 3-ribbed, with rounded ridges on the back of the carpels, 1½′–2′ long, 1′–1½′ wide, with a thin firm light brown ligneous outer coat closely ad-

Fig. 114

herent to the lustrous light yellow inner coat, in ripening splitting from the top to the bottom between the carpels, and through their backs at the apex; **seeds** ⅓′ wide and about $\frac{1}{32}$′ thick, with a smooth coat and a thin brittle wide margin to the rim.

A tree, with a rough much-branched underground stem penetrating deep into the soil and a trunk often 15°–20° high and 7′–8′ in diameter, covered above with a thick thatch of the pendant dead leaves of many years, simple, or branched at the top with a few short stout branches densely covered with leaves at first erect, then spreading nearly at right angles, and finally pendulous. **Bark** dark brown, irregularly fissured, broken into thin plates, about ¼′ thick. **Wood** light, soft, spongy, pale brown or yellow.

Distribution. High desert plateaus from southwestern Texas to southern Arizona; southward into northern Mexico; most abundant and of its largest size on the eastern slope of the continental divide in southern New Mexico and along the northern rim of the Tucson Desert in Arizona.

Division II. Dicotyledones.

Stems formed of bark, wood, and pith, and increasing by the addition of an annual layer of wood inside the bark. Parts of the flower mostly in 4's and 5's; embryo with a pair of opposite cotyledons. Leaves netted-veined.

Subdivision 1. Apetalæ. Flowers without a corolla and sometimes without a calyx (with a corolla in *Olacaceæ*).

Section 1. Flowers in unisexual aments (*female flowers of Juglans and Quercus solitary or in spikes*); ovary inferior (*superior in Leitneriaceæ*) when calyx is present.

V. SALICACEÆ.

Trees or shrubs, with watery juice, alternate simple stalked deciduous leaves with stipules, soft light usually pale wood, astringent bark, scaly buds, and often stoloniferous roots. Flowers appearing in early spring usually before the leaves, solitary in the axils of the scales of unisexual aments from buds in the axils of leaves of the previous year, the male and female on different plants; perianth 0; stamens 1, 2 or many, their anthers introrse, 2-celled, the cells opening longitudinally; styles usually short or none; stigmas 2–4, often 2-lobed. Fruit a 1-celled 2–4-valved capsule, with 2–4 placentas bearing below their middle numerous ascending anatropous seeds without albumen and surrounded by tufts of long white silky hairs attached to the short stalks of the seeds and deciduous with them; embryo straight, filling the cavity of the seed; cotyledons flattened, much longer than the short radicle turned toward the minute hilum.

The two genera of this family are widely scattered but most abundant in the northern hemisphere, with many species, and are often conspicuous features of vegetation.

CONSPECTUS OF THE GENERA.

Scales of the aments laciniate; flowers surrounded by a cup-shaped often oblique disk; stamens numerous; buds with numerous scales. 1. **Populus.**

Scales of the aments entire; disk a minute gland-like body; stamens 1, 2 or many; buds with a single scale. 2. **Salix.**

1. POPULUS L. Poplar.

Large fast-growing trees, with pale furrowed bark, terete or angled branchlets, resinous winter-buds covered by several thin scales, those of the first pair small and opposite, the others imbricated, increasing in size from below upward, accrescent and marking the base of the branchlet with persistent ring-like scars, and thick roots. Leaves involute in the bud, usually ovate or ovate-lanceolate, entire, dentate with usually glandular teeth, or lobed, penniveined, turning yellow in the autumn; petioles long, often laterally compressed, sometimes furnished at the apex on the upper side with 2 nectariferous glands, leaving in falling oblong often obcordate, elliptic, arcuate, or shield-shaped leaf-scars displaying the ends of 3 nearly equidistant fibro-vascular bundles; stipules caducous, those of the first leaves resembling the bud-scales, smaller higher on the branch, and linear-lanceolate and scarious on the last leaves. Flowers in pendulous stalked aments, the pistillate lengthening and rarely becoming erect before maturity; scales obovate, gradually narrowed into slender stipes, dilated and lobed, palmately cleft or fimbriate at apex, membranaceous, glabrous or villose, more crowded on the staminate than on the pistillate ament, usually caducous; disk of the flower broadly cup-shaped, often oblique, entire, dentate or irregularly lobed, fleshy or membranaceous, stipitate, usually persistent under the fruit; stamens 4–12 or 12–60 or more, inserted on the disk, their filaments free, short, light yellow; anthers ovoid or oblong, purple or red; ovary sessile in the bottom of the disk, oblong-conical, sub-globose or ovoid-oblong, cylindric or slightly lobed, with 2 or 3 or rarely 4 placentas; styles usually short; stigmas as many as the placentas, divided into filiform lobes or broad, dilated, 2-parted or lobed. Fruit ripening before the full growth of the leaves, greenish, reddish brown, or buff color, oblong-conic, subglobose or ovoid-oblong, separating at maturity into 2–4 recurved valves. Seeds broadly obovoid or ovoid, rounded or acute at the apex, light chestnut-brown; cotyledons elliptic.

Populus in the extreme north often forms great forests, and is common on the alluvial bottom-lands of streams and on high mountain slopes, ranging from the Arctic Circle to northern Mexico and Lower California and from the Atlantic to the Pacific in the New World, and to northern Africa, the southern slopes of the Himalayas, central China, and

Japan in the Old World. Of the thirty-four species now generally recognized fifteen are found in North America. The wood of many of the American species is employed in large quantities for paper-making, and several species furnish wood used in construction and in the manufacture of small articles of woodenware. The bark contains tannic acid and is used in tanning leather and occasionally as a tonic, and the fragrant balsam contained in the buds of some species is occasionally used in medicine. The rapidity of their growth, their hardiness and the ease with which they can be propagated by cuttings, make many of the species useful as ornamental trees or in wind-breaks, although planted trees often suffer severely from the attacks of insects boring into the trunks and branches. Of the exotic species, the Abele, or White Poplar, *Populus alba* L., of Europe and western Asia, and its fastigiate form, and the so-called Lombardy Poplar, a tree of pyramidal habit and a form of the European and Asiatic *Populus nigra* L., and one of its hybrids, have been largely planted in the United States.

Populus, of obscure derivation, is the classical name of the Poplar.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Stigmas 2, 2-lobed, their lobes filiform; leaf stalks elongated, laterally compressed; buds slightly resinous.
- Leaves finely serrate; winter-buds glabrous. **1. P. tremuloides** (A, B, F, G).
- Leaves coarsely serrate; winter-buds tomentose or pubescent. **2. P. grandidentata.**

Stigmas 2–4, 2-lobed and dilated, their lobes variously divided; buds resinous.
- Leaf-stalks round.
  - Leaves tomentose below early in the season, broadly ovate, acute or rounded at apex. **3. P. heterophylla** (A, C).
  - Leaves glabrous or pilose below.
    - Leaves dark green above, pale, rarely pilose below.
      - Ovary and capsule glabrous. **4. P. tacamahacca** (A, B, F).
      - Ovary and capsule tomentose or pubescent. **5. P. trichocarpa** (B, F).
    - Leaves light green on both surfaces, glabrous.
      - Leaves lanceolate to ovate-lanceolate. **6. P. angustifolia** (F).
      - Leaves rhombic-lanceolate to ovate. **7. P. acuminata** (F).
- Leaf-stalks laterally compressed.
  - Leaves without glands at apex of the petiole, coarsely serrate, thick.
    - Pedicels shorter than the fruit.
      - Disk cup-shaped.
        - Branchlets stout; capsule $\frac{1}{3}'$–$\frac{1}{2}'$ long. **8. P. Fremontii** (G, H).
        - Branchlets slender; capsule not more than $\frac{1}{4}'$ long. **9. P. arizonica** (F, H).
      - Disk minute.
        - Branchlets glabrous; leaves broad-ovate to deltoid, long-pointed and acuminate at apex. **10. P. texana** (C).
        - Branchlets pubescent; leaves broad-ovate, abruptly short-pointed or acute at apex. **11. P. McDougallii** (G, H).
    - Pedicels 2 or 3 times longer than the fruit; leaves broadly deltoid, abruptly short-pointed. **12. P. Wislizenii** (E, F).
  - Leaves furnished with glands at apex of the petiole.
    - Branchlets stout; leaves thick.
      - Winter-buds puberulous; leaves coarsely serrate; branchlets light yellow. **13. P. Sargentii** (F).
      - Winter-buds glabrous; leaves less coarsely serrate; branchlets gray or reddish brown. **14. P. balsamifera** (A, C).
    - Branchlets slender; leaves thin, ovate, cuneate or rounded at base, finely serrate. **15. P. Palmeri** (E).

1. Populus tremuloides Michx. Aspen. Quaking Asp.

Leaves ovate to broad-ovate or rarely reniform (var. *reniformis* Tidestrom) abruptly short-pointed or acuminate at apex rounded or rarely cuneate at the wide base, closely crenately serrate with glandular teeth, thin, green and lustrous above, dull green or rarely pale below, up to $4\frac{1}{2}'$ long and broad with a prominent midrib, slender primary veins and conspicuous reticulate veinlets; petioles slender, compressed laterally, $1\frac{1}{2}'$–$3'$ long. **Flowers:** aments $1\frac{1}{2}'$–$2\frac{1}{2}'$ long, the pistillate becoming $4'$ in length at maturity; scales deeply divided into 3–5 linear acute lobes fringed with long soft gray hairs; disk oblique, the staminate entire, the pistillate slightly crenate; stamens 6–12; ovary conic, with a short thick style and erect stigmas thickened and club-shaped below and divided into linear diverging lobes. **Fruit** maturing in May and June, oblong-conic, light green, thin-walled, nearly $\frac{1}{4}'$ long; **seeds** obovoid, light brown, about $\frac{1}{32}'$ in length.

A tree, 20°–40° high, with a trunk 18′–20′ in diameter, slender remote and often contorted branches somewhat pendulous toward the ends, forming a narrow symmetrical

Fig. 115

round-topped head, and slender branchlets covered with scattered oblong orange-colored lenticels, bright red-brown and very lustrous during their first season, gradually turning light gray tinged with red, ultimately dark gray, and much roughened for two or three years by the elevated leaf-scars. **Winter-buds** slightly resinous, conic, acute, often incurved, about $\frac{1}{4}'$ long, narrower than the more obtuse flower-buds, with 6 or 7 lustrous glabrous red-brown scales scarious on the margins. **Bark** thin, pale yellow-brown or orange-green, often roughened by horizontal bands of circular wart-like excrescences, frequently marked below the branches by large rows of lunate dark scars. **Wood** light brown, with nearly white sapwood of 25–30 layers of annual growth.

Distribution. Southern Labrador to the southern shores of Hudson's Bay and northwesterly to the mouth of the Mackenzie River, through the northern states to the mountains of Pennsylvania, northern Ohio, Indiana and Illinois, eastern and central Iowa and northeastern Missouri; common and generally distributed usually on moist sandy soil and gravelly hillsides; most valuable in the power of its seeds to germinate quickly in soil made fertile by fire and of its seedlings to grow rapidly in exposed situations; westward passing into the var. *aurea* Daniels, with thicker rhombic to semiorbicular or broad-ovate generally smaller leaves, usually pale on the lower surface, rounded or acute and minutely short-pointed at apex, rounded or cuneate at base, often entire with slightly

thickened margins, or occasionally coarsely crenately serrate, with inconspicuous reticulate veinlets, turning bright golden yellow in the autumn before falling.

A tree occasionally 100° high with a trunk up to 3° in diameter, with pale often white bark, becoming near the base of old stems 2′ thick, nearly black, and deeply divided into broad flat ridges broken on the surface into small appressed plate-like scales.

Distribution. Valley of the Yukon River to Saskatchewan, and southward through the mountain ranges of the Rocky Mountain region to southern New Mexico, the San Francisco Mountains of Arizona, and westward to the valley of the Skeena River, British Columbia, western Washington and Oregon, the western slopes of the Sierra Nevada and the high mountains of southern California, and eastward to North and South Dakota and western Nebraska; on the mountains of Chihuahua, and on the Sierra de Laguna, Lower California.

Populus tremuloides var. vancouveriana Sarg.

Populus vancouveriana Trel.

Leaves broadly ovate to semiorbicular, abruptly short-pointed or rounded at apex, rounded or slightly cordate at the broad base, coarsely crenately serrate and sometimes obscurely crispate on the margins, when they unfold covered below and on the petioles with

Fig. 116

a thick coat of long matted pale hairs, and slightly villose, glabrous or nearly glabrous above, soon glabrous, and at maturity thick dark green, lustrous and scabrate on the upper surface, paler on the lower surface, 3′–4½′ long and broad, with a prominent midrib and primary veins; petioles slender, compressed, becoming glabrous, 2′–3′ in length. **Flowers:** staminate aments slightly villose; pedicels pubescent; disk of the flower puberulous toward the base; flowers as in the species; pistillate aments 2′–2¼′ long, becoming 3–3½′ in length at maturity; the rachis, pedicels and slightly lobed disk of the flower densely villose-pubescent; ovary conic, pubescent, with a short style and stigma divided into narrow divergent lobes. **Fruit** on pedicel not more than ¼′ in length, oblong-conic, pubescent or glabrous, ¼′ long.

A tree 30°–36° high, with a trunk 12′–16′ in diameter, stout spreading branches forming a round-topped head, stout, reddish brown pubescent or puberulous branchlets often becoming glabrous during their first summer. **Winter-buds** acute, tomentose, pubescent or glabrous.

Coast of Vancouver Island, British Columbia and shores of Puget Sound; Tualitin, Washington County, and valley of the Willamette River at Corvallis, Benton County, Oregon.

2. Populus grandidentata Michx. Poplar.

Leaves semiorbicular to broad-ovate, short-pointed at apex, rounded, abruptly cuneate or rarely truncate at the broad entire base, coarsely repand-dentate above with few stout incurved teeth, covered like the petioles early in the season with white tomentum, soon glabrous, thin and firm in texture, dark green above, paler on the lower surface, 2′–3′ long, 2′–2½′ wide, with a prominent yellow midrib, conspicuously forked veins, and reticulate veinlets; petioles slender, laterally compressed, 1½′–2½′ long. **Flowers:** aments pubescent, 1½′–2½′ long, the pistillate becoming 4′–5′ long at maturity; scales pale and scarious below, divided above into 5 or 6 small irregular acute lobes covered with soft pale hairs; disk shallow, oblique, the staminate entire, the pistillate slightly crenate; stamens 6–12, with short slender filaments and light red anthers; ovary oblong-conic, bright green, puberulous, with

Fig. 117

a short style, and spreading stigmas divided nearly to the base into elongated filiform lobes. **Fruit** ripening before the leaves are fully grown, often more or less curved above the middle, light green and puberulous, thin-walled, 2-valved, about ⅛′ long; pedicel slender, pubescent, about ½′ in length; **seeds** minute dark brown.

A tree, often 60°–70° high, with a trunk occasionally 2° in diameter, slender rather rigid branches forming a narrow round-topped head, and stout branchlets marked by scattered oblong orange-colored lenticels, coated when they first appear with thick hoary deciduous tomentum, becoming during their first year dark red-brown or dark orange-colored, glabrous, lustrous, or covered with a delicate gray pubescence, and in their second year dark gray sometimes slightly tinged with green and much roughened by the elevated 3-lobed leaf-scars; generally smaller, and usually not more than 30°–40° tall. **Winter-buds** terete, broadly ovoid, acute, with light bright chestnut-brown scales, pubescent during the winter especially on their thin scarious margins, about ¼′ long and not more than half the size of the flower-buds. **Bark** thin, smooth, light gray tinged with green, becoming near the base of old trunks ¾′–1′ thick, dark brown tinged with red, irregularly fissured and divided into broad flat ridges roughened on the surface by small thick closely appressed scales. **Wood** light brown, with thin nearly white sapwood of 20–30 layers of annual growth.

Distribution. Rich moist sandy soil near the borders of swamps and streams; Nova Scotia, through New Brunswick, southern Quebec and Ontario to northern Minnesota,

southward through the northern states to Pennsylvania, northern Ohio, and eastern (Muscatine County) and central Iowa, and westward to central Kentucky and Tennessee; passing into the var. *meridionalis* Tidestrom with broad-ovate acuminate leaves with more numerous teeth, often 4′–5′ long and 3′ wide; the common form in Maryland, northern Delaware, the piedmont region of Virginia and North Carolina, southern Ohio, and southern Indiana and Illinois; rare northward to northern New England.

3. Populus heterophylla L. Swamp Cottonwood. Black Cottonwood.

Leaves broadly ovate, gradually narrowed and acute, short-pointed or rounded at apex, slightly cordate or truncate or rounded at the wide base, usually furnished with a narrow deep sinus, finely or coarsely crenately serrate with incurved glandular teeth, covered as they unfold with thick hoary deciduous tomentum, becoming thin and firm in texture, dark deep green above, pale and glabrous below, with a stout yellow midrib, forked veins and conspicuous reticulate veinlets, 4′–7′ long, 3′–6′ wide; petioles slender terete tomentose or nearly glabrous $2\frac{1}{2}$′–$3\frac{1}{2}$ in length. **Flowers:** staminate aments broad, densely flowered, 1′ long, erect when the flowers first open, becoming pendulous and 2′–$2\frac{1}{2}$′ long; scales narrowly oblong-obovate, brown, scarious and glabrous below, divided into numerous elon-

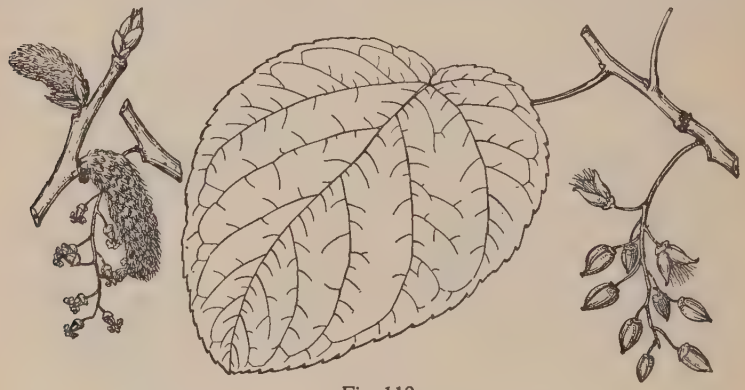

Fig. 118

gated filiform light red-brown lobes; disk oblique, slightly concave; stamens 12–20, with slender filaments about as long as the large dark red anthers; pistillate aments slender, pendulous, few-flowered, 1′–2′ long, becoming erect and 4′–6′ long before maturing, their scales concave and infolding the flowers, linear-obovate, brown and scarious, laterally lobed, fimbriate above the middle, caducous; disk thin, irregularly divided in numerous triangular acute teeth, long-stalked; ovary ovoid, terete or obtusely 3-angled, with a short stout elongated style and 2 or 3 much-thickened dilated 2 or 3-lobed stigmas. **Fruit** on elongated pedicels, ripening when the leaves are about one third grown, ovoid, acute, dark red-brown, rather thick-walled, 2 or 3-valved, about $\frac{1}{2}$′ long; **seeds** obovoid, minute, dark red-brown.

A tree, 80°–90° high, with a tall trunk 2°–3° in diameter, short rather slender branches forming a comparatively narrow round-topped head, and stout branchlets, marked by small elongated pale lenticels, coated at first with hoary caducous tomentum, becoming dark brown and rather lustrous or ashy gray, or rarely pale orange color and glabrous or slightly puberulous, or covered with a glaucous bloom in their first winter, growing darker in their second year and much roughened by the large thickened leaf-scars; usually much smaller and at the north rarely more than 40° tall. **Winter-buds** slightly resinous, broadly ovoid, acute, with bright red-brown scales, about $\frac{1}{4}$′ long and about one half the size of the

flower-buds. **Bark** on young trunks divided by shallow fissures into broad flat ridges separating on the surface into thick plate-like scales, becoming on old trunks $\frac{3}{4}'$–$1'$ thick, light brown tinged with red, and broken into long narrow plates attached only at the middle and sometimes persistent for many years. **Wood** dull brown, with thin lighter brown sapwood of 12–15 layers of annual growth; now often manufactured into lumber in the valley of the Mississippi River and in the Gulf states, and as black poplar used in the interior finish of buildings.

Distribution. Southington, Connecticut, and Northport, Long Island, southward near the coast to southern Georgia, and the valley of the lower Apalachicola River, Florida, through the Gulf states to western Louisiana, and through eastern Arkansas to southeastern Missouri, western Kentucky and Tennessee, southern Illinois, northern Indiana (Laporte and Wells Counties), and in central and northern Ohio (Williams, Ottawa and Lake Counties); in the north Atlantic states in low wet swamps, rare and local; more common south and west on the borders of river swamps; very abundant and of its largest size in the valley of the lower Ohio and in southeastern Missouri, eastern Arkansas, and western Mississippi.

4. Populus tacamahaca Mill. Balsam. Tacamahac.

Populus balsamifera Du Roi, not L.

Leaves ovate-lanceolate, gradually narrowed and acuminate at apex, cordate or rounded at base, or narrow-elliptic and acute or acuminate at the ends, finely crenately serrate, with slightly thickened revolute margins, coated when they unfold with the gummy secretions

Fig. 119

of the bud, glabrous, or puberulous on the under side of the midrib, becoming thin and firm in texture, deep dark green and lustrous above, pale green or glaucous and more or less rusty and conspicuously reticulate-venulose below, $3'$–$5'$ long, $1\frac{1}{2}'$–$3'$ wide, with thin veins running obliquely almost to the margins; petioles slender, terete, $1\frac{1}{2}'$ long, glabrous or rarely puberulous. **Flowers:** aments long-stalked, the pistillate becoming $4'$–$5'$ long before the fruit ripens, glabrous or pubescent; scales broadly obovate, light brown and scarious, often irregularly 3-parted at apex, cut into short thread-like brown lobes; disk of the staminate flower oblique, short-stalked; stamens 20–30, with short filaments and large light red anthers; disk of the pistillate flower cup-shaped; ovary ovoid, slightly 2-lobed, with two nearly sessile large oblique dilated crenulate stigmas. **Fruit** ovoid-oblong, acute and often curved at apex, 2-valved, light brown, about $\frac{1}{4}'$–$\frac{1}{3}'$ long, nearly sessile or short-stalked, $\frac{1}{2}'$–$\frac{1}{8}'$ in length; seeds oblong-obovoid, pointed at apex, narrowed and truncate at base, light brown. about $\frac{1}{12}'$ long.

A tree, often 100° high, with a tall trunk 6°–7° in diameter, stout erect branches usually

more or less contorted near the ends, forming a comparatively narrow open head, and glabrous or occasionally pubescent branchlets marked by oblong bright orange-colored lenticels, much roughened by the thickened leaf-scars, at first red-brown and glabrous or pubescent, becoming bright and lustrous in their first winter, dark orange-colored in their second year, and finally gray tinged with yellow-green; usually much smaller toward the southern limits of its range. **Winter-buds** saturated with a yellow balsamic sticky exudation, ovoid, terete, long-pointed; terminal 1′ long, $\frac{1}{3}$′ broad; axillary about $\frac{3}{4}$′ long, $\frac{1}{16}$′ broad, with 5 oblong pointed concave closely imbricated thick chestnut-brown lustrous scales. **Bark** light brown tinged with red, smooth or roughened by dark excrescences, becoming on old trunks $\frac{3}{4}$′–1′ thick, gray tinged with red, and divided into broad rounded ridges covered by small closely appressed scales. **Wood** light brown, with thick nearly white sapwood.

Distribution. Low often inundated river-bottom lands and swamp borders; Labrador to latitude 65° north in the valley of the Mackenzie River, and to the Alaskan coast, south to northern New England and New York, central Michigan, Minnesota (except in southern and southwestern counties), Turtle Mountains, Rolette County, North Dakota, the Black Hills of South Dakota, northwestern Nebraska (basin of Hat Creek), and in Colorado; the characteristic tree on the streams of the prairie region of British America, attaining its greatest size on the islands and banks of the Peace, Athabasca, and other tributaries of the Mackenzie; common in all the region near the northern boundary of the United States from Maine to the western limits of the Atlantic forests; the largest of the sub-Arctic American trees, and in the far north the most conspicuous feature of vegetation; passing into the variety *Michauxii* Farwell, with more cordate leaves, slightly pilose on the under side of the midrib and veins; common from Aroostook County, Maine, to the Province of Quebec, Newfoundland, and the shores of Hudson Bay.

Often planted at the north for shelter or ornament.

Populus candicans Ait., the Balm of Gilead of which only the pistillate tree is known, has often been considered a variety of the North American Balsam Poplar. This tree has been long cultivated in the northeastern part of the country and has sometimes escaped from cultivation and formed groves of considerable extent, as on the banks of Cullasagee Creek on the western slope of the Blue Ridge in Macon County, North Carolina. The fact that only one sex is known suggests hybrid origin but of obscure and possibly partly of foreign origin.

5. Populus trichocarpa Hook. Black Cottonwood. Balsam Cottonwood.

Leaves broad-ovate, acute or acuminate at apex, rounded or abruptly cuneate at base, finely crenately serrate, glabrous, dark green above, pale and rusty or silvery white and conspicuously reticulate-venulose below, 3′–4′ long, 2′–2½′ wide; petioles slender, pubescent, puberulous, pilose or rarely glabrous, 1½′–2′ in length. **Flowers:** aments stalked, villose-pubescent, the staminate densely flowered, 1½′–2′ long, $\frac{1}{3}$′ thick, the pistillate loosely flowered, 2½′–3′ long, becoming 4′–5′ long before the fruit ripens; scales dilated at the apex, irregularly cut into numerous filiform lobes, glabrous or slightly puberulous on the outer surface; disk of the staminate flower broad, slightly oblique; stamens 40–60, with slender elongated filaments longer than the large light purple anthers; disk of the pistillate flower deep cup-shaped, with irregularly crenate or nearly entire revolute margins; ovary subglobose, coated with thick hoary tomentum, with 3 nearly sessile broadly dilated deeply lobed stigmas. **Fruit** subglobose, nearly sessile, pubescent, thick-walled, 3-valved; **seeds** obovoid, apiculate at the gradually narrowed apex, light brown, puberulous toward the ends, $\frac{1}{12}$′ long.

A tree, 30°–100° high, with a trunk 1°–3° in diameter, erect branches forming an open head, and slender branchlets terete or slightly angled while young, marked by many orange-colored lenticels, glabrous or when they first appear coated with deciduous rufous or pale pubescence, reddish brown during their first year, gradually becoming dark gray, and roughened by the greatly enlarged and thickened elevated leaf-scars. Winter-buds resin-

ous, fragrant, ovoid, long-pointed, frequently curved above the middle, $\frac{3}{4}'$ long and $\frac{1}{4}'$ thick, with 6 or 7 light orange-brown slightly puberulous scales scarious on the margins. **Bark** $\frac{1}{2}'$–$2\frac{1}{2}'$ thick, ashy gray, deeply divided into broad rounded ridges broken on the surface into thick closely appressed scales. **Wood** light, dull brown, with thin nearly white sapwood.

Fig. 120

Distribution. In California in small groves with widely scattered individuals on the coast ranges, the western slope of the Sierra Nevada up to elevations of 6000°–8000°, and on the southern mountains to Mt. Palomar in San Diego County; on the California islands, and on the western slopes of the San Pedro Mártir Mountains, Lower California.

On the high Sierra Nevada and in northern California passing into the var. *hastata* A. Henry, differing in its thicker leaves, usually longer in proportion to their width, often long-acuminate, rounded or cordate at base, frequently 5′ or 6′ long and 3′ or 4′ wide, with glabrous petioles and larger sometimes nearly glabrous capsules on glabrous or pubescent aments, sometimes 10′–12′ in length, and in its glabrous young branchlets.

A tree sometimes 200° high, with a trunk 7°–8° in diameter, and the largest deciduous-leaved tree of northwestern North America. The wood is largely used in Oregon and Washington for the staves of sugar barrels and in the manufacture of woodenware.

Distribution. In open groves on rich bottom lands of streams from Siskiyou County, California, to southern Alaska; eastward in the United States through Oregon and Washington to western and southern Idaho; and to the mountains of western Nevada; in British Columbia to the valley of the Columbia River; on the banks of the east fork of the Kaweah River, Tulare County, California, at 10,000° above the sea.

6. Populus angustifolia James. Narrow-leaved Cottonwood.

Populus fortissima A. Nels & Macbr.

Leaves lanceolate, ovate-lanceolate, elliptic or rarely obovate, narrowed to the tapering acute or rounded apex, gradually narrowed and cuneate or rounded at base, finely or on vigorous shoots coarsely serrate, thin and firm, bright yellow-green above, glabrous or rarely puberulous and paler below, 2′–3′ long, $\frac{1}{2}'$–1′ wide, or on vigorous shoots occasionally 6′–7′ long, and $1\frac{1}{2}'$ wide, with a stout yellow midrib and numerous slender-oblique primary veins arcuate and often united near the slightly thickened revolute margins; petioles slender, somewhat flattened on the upper side, and in falling leaving small nearly oval obcordate scars. **Flowers:** aments densely flowered, glabrous, short-stalked, $\frac{1}{2}'$–$2\frac{1}{2}'$ long, the pistillate becoming $2\frac{1}{2}'$–4′ long before the fruit ripens; scales broadly obovate, glabrous, thin, scarious, light brown, deeply and irregularly cut into numerous

dark red-brown filiform lobes; disk of the staminate flower cup-shaped, slightly oblique, short-stalked; stamens 12–20, with short filaments and large light red anthers; disk of the pistillate flower shallow, cup-shaped, slightly and irregularly lobed, short-stalked; ovary ovoid, more or less 2-lobed, with a short or elongated style and 2 oblique dilated irregularly lobed stigmas. **Fruit** broadly ovoid, often rather abruptly contracted above the middle, short-pointed, thin-walled, 2-valved; pedicels often $\frac{1}{3}'$ long; **seeds** ovoid or obovoid, rather obtuse, light brown, nearly $\frac{1}{8}'$ long.

Fig. 121

A tree, 50°–60° high, with a trunk rarely more than 18′ in diameter, slender erect branches forming a narrow and usually pyramidal head, and slender glabrous or rarely puberulous branchlets marked by pale lenticels, at first light yellow-green, becoming bright or dark orange color in their first season, pale yellow in their second winter, and ultimately ashy gray. **Winter-buds** very resinous, ovoid, long-pointed, covered by usually 5 thin concave chestnut-brown scales; terminal $\frac{1}{4}'$–$\frac{1}{2}'$ long and nearly twice as large as the axillary buds. **Bark** $\frac{3}{4}'$–1′ thick, light yellow-green, divided near the base of old trees by shallow fissures into broad flat ridges, smooth and much thinner above. **Wood** light brown, with thin nearly white sapwood of 10–30 layers of annual growth.

Distribution. Banks of streams usually at altitudes of 5000°–10,000° above the sea; southern Alberta to the Black Hills of South Dakota and northwestern Nebraska (basin of Hat Creek) westward through Wyoming, Montana and Idaho to Yakima County, Washington, and southward to central Nevada, southwestern New Mexico (Silver City, Grant County) and northern Arizona; the common Cottonwood of northern Colorado, Utah, Wyoming, southern Montana, and eastern Idaho; on the mountains of Chihuahua.

7. Populus acuminata Rydb. Cottonwood.

Leaves rhombic-lanceolate to ovate, abruptly acuminate, gradually or abruptly narrowed and cuneate or concave-cuneate, or rarely broad and rounded at the mostly entire base, coarsely crenately serrate except near the apex, dark green and lustrous above, dull green below, 2′–4′ long, $\frac{3}{4}'$–2′ wide, with a slender yellow midrib, thin remote primary veins and obscure reticulate veinlets; petioles slender, nearly terete, 1′–3′ long. **Flowers:** aments slender, short-stalked, 2′–3′ long, the pistillate becoming 4′ or 5′ long before the fruit ripens; scales scarious, light brown, glabrous, dilated and irregularly divided into filiform lobes; disk of the staminate flower wide, oblique, and membranaceous; stamens numerous, with short filaments and dark red anthers; disk of the pistillate flower deep cup-shaped; ovary broad-ovoid, gradually narrowed above, with large laciniately lobed nearly sessile stigmas. **Fruit** pedicellate, oblong-ovoid, acute, thin-walled, slightly pitted,

about $\frac{1}{3}'$ long, 3 or rarely 2-valved; seeds oblong-obovoid, rounded at the apex, light brown, about $\frac{1}{12}'$ in length.

A tree, usually about 40° high, with a trunk 12′–18′ in diameter, stout spreading and ascending branches forming a compact round-topped head, and slender terete or slightly 4-angled pale yellow-brown branchlets roughened for two or three years by the elevated oval horizontal leaf-scars. **Winter-buds** acuminate, resinous, about $\frac{1}{3}'$ long, with 6 or 7 light chestnut-brown lustrous scales. **Bark** on young stems and large branches smooth, nearly white, becoming on old trunks pale gray-brown, about $\frac{1}{2}'$ thick, deeply divided into broad flat ridges.

Fig. 122

Distribution. Banks of streams in the arid eastern foothill region of the Rocky Mountains; Assiniboia to the Black Hills of South Dakota, northwestern Nebraska, eastern Wyoming, southern Colorado, and southwestern New Mexico (Fort Bayard, Grant County); in Colorado crossing the Continental Divide to southeastern Utah; passing into the var. *Rehderi* Sarg. differing in the larger leaves on longer petioles, and in the pubescent branchlets and winter-buds. Borders of streams southeastern New Mexico.

Sometimes planted as a shade-tree in the streets of cities in the Rocky Mountain region.

× *Populus Andrewsii* Sarg. intermediate in its character between *P. acuminata* and *P. Sargentii* and believed to be a natural hybrid of these species has been found growing naturally near Boulder and Walsenburg, Colorado, and as a street tree in Montrose, Colorado.

8. Populus Fremontii S. Wats. Cottonwood.

Leaves deltoid or reniform, generally contracted into broad short entire points, or rarely rounded or emarginate at apex, truncate, slightly cordate or abruptly cuneate at the entire base, coarsely and irregularly serrate, with few or many incurved gland-tipped teeth, coated like the petioles when they unfold with short spreading caducous pubescence, at maturity thick and firm, glabrous bright green and lustrous, 2′–$2\frac{1}{2}'$ long, $2\frac{1}{2}'$–3′ wide, with a thin yellow midrib and 4 or 5 pairs of slender veins; petioles flattened, yellow, $1\frac{1}{2}'$–3′ long. **Flowers:** staminate aments densely flowered, $1\frac{1}{2}'$–2′ long, nearly $\frac{1}{2}'$ thick, with slender glabrous stems, the pistillate sparsely flowered, with stout glabrous or puberulous stems, becoming before the fruit ripens 4′ or 5′ long; scales light brown, thin and scarious, dilated and irregularly cut at apex into filiform lobes; disk of the staminate flower broad, oblique, slightly thickened on the entire revolute margin; stamens 60 or more, with large dark red

anthers; disk of the pistillate flower cup-shaped; ovary ovoid or ovoid-oblong, with 3 or rarely 4 broad irregularly crenately lobed stigmas. **Fruit** ovoid, acute or obtuse, slightly

Fig. 123

pitted, thick-walled, 3 or rarely 4-valved, $\frac{1}{3}'$–$\frac{1}{2}'$ long; pedicel stout, from $\frac{1}{20}'$–$\frac{1}{6}'$ long; **seeds** ovoid, acute, light brown, nearly $\frac{1}{8}'$ in length.

A tree, occasionally 100° high, with a short trunk 5°–6° in diameter, stout spreading branches pendulous at the ends and forming a broad rather open graceful head, and slender terete branchlets light green and glabrous, becoming light yellow before winter, dark or

Fig. 124

light gray more or less tinged with yellow in their second year, and only slightly roughened by the small 3-lobed leaf-scars. **Winter-buds** ovoid, acute, with light green lustrous

scales, the terminal usually about $\frac{1}{3}'$ long and usually two or three times as large as the lateral buds. **Bark** on young stems light gray-brown, thin, smooth or slightly fissured, becoming on old trees $1\frac{1}{2}$–$2'$ thick, dark brown slightly tinged with red, and deeply and irregularly divided into broad connected rounded ridges covered with small closely appressed scales. **Wood** light brown, with thin nearly white sapwood.

Distribution. Banks of streams; valley of the upper Sacramento River southward through western California to the San Pedro Mártir Mountains, Lower California; most abundant in the San Joaquin Valley, and ascending the western slopes of the southern Sierra Nevada to altitudes of 3000°.

Often planted in southern California as a shade-tree, and for the fuel produced quickly and abundantly from pollarded trees.

In San Bernardino and San Diego Counties, California, generally replaced by the var. *pubescens* Sarg., differing in its pubescent branchlets and ranging eastward to southwestern Nevada and southern Utah. In southern Arizona and near Silver City, Grant County, New Mexico, represented by the var. *Thornberii* Sarg., differing from the typical *P. Fremontii* in the more numerous serratures of the leaves, in the ellipsoidal not ovoid capsules with smaller disk and shorter pedicels, and by the var. *Toumeyi* Sarg., differing from the type in the shallow cordate base of the leaves, gradually narrowed and cuneate to the insertion of the petiole, and in the larger disk of the fruit (Fig. 124). The var. *macrodisca* Sarg. with a broad disc nearly inclosing the ellipsoidal fruit is known only in the neighborhood of Silver City.

× *Populus Parryi* Sarg., a probable hybrid of *P. Fremontii* and *P. trichocarpa*, with characters intermediate between those of its supposed parents, grows naturally along Cottonwood Creek on the west side of Owens Lake, Inyo County, and in the neighborhood of Fort Tejon, Kern County, and as a street tree is not rare in San Bernardino, California.

9. Populus arizonica Sarg. Cottonwood.

Populus mexicana Sarg. not Wesm.

Leaves deltoid or reniform, gradually or abruptly long-pointed at the acuminate entire apex, truncate or broad-cuneate at the wide base, finely serrate with numerous teeth, as

Fig. 125

they unfold dark red covered below with pale pubescence, pubescent above, ciliate on the margins, thin, glandular with bright red caducous glands, soon becoming glabrous, at

maturity subcoriaceous, bright yellow-green, very lustrous, $1\frac{1}{2}'$–$2'$ long and broad, with a slender yellow midrib and obscure primary veins; petioles laterally compressed, sparingly villose when they first appear, soon glabrous, $1\frac{1}{2}'$–$2'$ long; leaves on vigorous leading shoots often rounded at apex, cuneate at base, and often $2'$ long and $3'$ wide, with petioles often $3'$ in length. **Flowers**: staminate aments dense, cylindric, $1'$–$1\frac{1}{2}'$ long, the pistillate slender, many-flowered, $1\frac{1}{2}'$–$2'$ long, becoming $3'$–$4'$ long before the fruit ripens; disk of the staminate flower broad-oblong; stamens numerous; disk of the pistillate flower deep cup-shaped, nearly entire; ovary ovoid, rounded at apex, slightly 3 or 4-angled, short-stalked, nearly inclosed in the cup-shaped membranaceous disk. **Fruit** on short stout pedicels, round-ovoid, buff color, slightly 3 or 4-lobed, deeply pitted, thin-walled, about $\frac{1}{4}'$ long.

A tree, 50°–70° high, with a trunk occasionally 3° in diameter, gracefully spreading and ascending branches forming a broad open head of wide-spreading branches, and slender often pendulous branchlets, pale green and glabrous or puberulous when they first appear, soon becoming glabrous, and light yellow during their first season. **Winter-buds** narrow, acute, light orange-brown, puberulous toward the base of the outer scales, the terminal about $\frac{1}{4}'$ long, and two or three times as large as the much-compressed oblong lateral buds. **Bark** pale gray or rarely white, and deeply divided into broad flat ridges.

Distribution. Banks of mountain streams; southwestern California (Mill Creek, above Forest Home, San Bernardino Mountains) and southern and central Arizona; widely distributed through northern Mexico (*var. Jonesii* Sarg.); well distinguished from the other Cottonwoods of the United States by its small fruit.

Often planted as a street tree in the towns of southern Arizona.

10. Populus texana Sarg.

Leaves thin, glabrous, broadly ovate, gradually narrowed, long-pointed and acuminate at apex, truncate at base, coarsely crenately serrate below the middle, entire above, $3'$–$3\frac{1}{4}'$

Fig. 126

long and $2\frac{1}{4}'$–$2\frac{1}{2}'$ wide; petioles slender, compressed, $1\frac{1}{2}'$–$2\frac{1}{2}'$ in length. **Flowers** not seen. **Fruit**: aments slender, glabrous, $2\frac{1}{2}'$–$3'$ long; fruit oblong-ovoid, acute, deeply pitted, glabrous, thin-walled, 3-valved, $\frac{1}{3}'$ in length; disk slightly lobed; pedicel slender, $\frac{1}{16}'$–$\frac{1}{8}'$ in length; seeds ovoid, acuminate, $\frac{1}{16}'$ long.

A tree up to 60° high, with a trunk sometimes 3° in diameter, stout more or less pendulous branches and stout glabrous pale yellow-brown branchlets. **Winter-buds** acuminate, glabrous.

In cañons and along the streams of northwestern Texas, where it appears to be the only Cottonwood.

11. Populus MacDougalii Rose.

Leaves broadly ovate, abruptly short-pointed or acute at apex, broadly or acutely cuneate or truncate, or on vigorous shoots rarely slightly cordate at base, finely or often coarsely crenately serrate, bluish green, thin, pubescent on the under sides of the midrib and primary veins early in the season, otherwise glabrous, $1\frac{1}{2}'$–$3'$ long and broad, with slender midribs and veins; petioles slender, slightly compressed, pubescent early in the season, becoming glabrous, $1\frac{1}{2}'$–$2'$ in length. **Flowers** not seen. **Fruit:** aments glabrous, short-stalked, $2'$–$2\frac{1}{2}'$ long; fruit ovoid and acute at apex to ellipsoidal and acute or acuminate at ends, glabrous, slightly pitted, thin-walled, 3-valved, $\frac{5}{12}'$–$\frac{1}{2}'$ long; disk not more than $\frac{1}{8}'$ in diameter; pedicels glabrous, $\frac{1}{8}'$–$\frac{1}{5}'$ in length; **seeds** oblong-ovoid, acuminate, $\frac{1}{8}'$ long.

Fig. 127

A tree rarely 90°–110° high, usually much smaller, with erect branches and slender branchlets pubescent or puberulous when they first appear, sometimes becoming glabrous during their first season, and sometimes pubescent during two years.

Distribution. Banks of streams and springs, San Bernardino County, California (Cottonwood Springs, Meca, etc.), and eastward to the bottoms of the Colorado River from Clark County, Nevada, to Yuma, Arizona, and probably the only Cottonwood in this arid region.

Often planted as a street tree in the towns of southwestern California and of adjacent Nevada and Arizona.

12. Populus Wislizenii Sarg. Cottonwood.

Leaves broadly deltoid, abruptly short- or long-pointed at apex, truncate or sometimes cordate at the broad entire base, coarsely and irregularly crenately serrate except toward the entire apex, coriaceous, glabrous, yellow-green and lustrous, $2'$–$2\frac{1}{2}'$ long, usually about $3'$ wide, with a slender yellow midrib, thin remote primary veins and conspicuous reticulate veinlets; petioles slender, glabrous, $1\frac{1}{2}'$–$2'$ long; on vigorous shoots often $3\frac{1}{2}'$–$4'$ long and wide with petioles $3\frac{1}{2}'$–$4'$ in length. **Flowers:** aments $2'$–$4'$ long, the pistillate becoming $4'$–$5'$ long before the fruit ripens; scales scarious, light red, divided at the apex into elongated filiform lobes; disk of the staminate flower broad and oblique; stamens numerous, with large oblong anthers and short filaments; disk of the pistillate flower cup-shaped,

irregularly dentate, inclosing to the middle the long stalked ovary full and rounded at apex, with 3 broad crenulate lobed stigmas raised on the short branches of the style. **Fruit** oblong-ovoid, thick-walled, acute, 3 or 4-valved, slightly ridged, buff color, $\frac{1}{4}'$ long; pedicels slender, $\frac{1}{2}'$–$\frac{3}{4}'$ in length and placed rather remotely on the slender glabrous rachis of the ament.

A large tree, with wide-spreading branches, and stout light orange-colored glabrous branchlets. **Winter-buds** acute lustrous, puberulous. **Bark** pale gray-brown, deeply divided into broad flat ridges. **Wood** used as fuel, for fence-posts and the rafters of Mexican houses.

Fig. 128

Distribution. Western Texas through New Mexico to the valley of Grand River, western Colorado (Grand Junction, Mesa County); common in the valley of the Rio Grande in western Texas and New Mexico, and the adjacent parts of Mexico.

Often planted as a shade tree in New Mexico.

13. Populus Sargentii Dode.

Populus deltoides var. *occidentalis* Rydb.

Leaves ovate, usually longer than broad, abruptly narrowed into a long slender entire acuminate point or rarely rounded at apex, truncate or slightly cordate at base, and coarsely crenately serrate, as they unfold slightly villose above and tomentose on the margins, soon glabrous, light green and very lustrous, 3′–$3\frac{1}{2}'$ long, $3\frac{1}{2}'$–4′ wide, with a thin midrib slender primary veins and reticulate veinlets occasionally furnished on the upper side at the insertion of the petiole with one or two small glands; petioles slender, compressed laterally, $2\frac{1}{2}'$–$3\frac{1}{2}'$ long. **Flowers:** aments short-stalked, glabrous, the staminate 2′–$2\frac{1}{2}'$ in length, the pistillate becoming 4′–8′ long before the fruit ripens; scales fimbriately divided at apex, scarious, light brown; disk of the staminate flower broad, oblique, slightly thickened on the margins; stamens 20 or more, with short filaments and yellow anthers; disk of the pistillate flower cup-shaped, slightly lobed on the margin; ovary subglobose, with 3 or 4 sessile dilated or laciniately lobed stigmas. **Fruit** oblong-ovoid, gradually or abruptly narrowed to the blunt apex, thin-walled, about $\frac{2}{5}'$ long and three or four times longer than the pedicel; **seeds** oblong-obovoid, rounded at apex, about $\frac{1}{15}'$ in length.

A tree 60°–90° tall with a trunk often 6° or 7° in diameter, erect and spreading branches forming a broad open head, and stout glabrous light yellow often angular branchlets conspicuously roughened by the elevated scars of fallen leaf-stalks. **Winter-buds** ovoid,

acute, with light orange-brown puberulous scales. **Bark** pale, thick, divided by deep fissures into broad rounded ridges broken into closely appressed scales.

Fig. 129

Distribution. The common Cottonwood along the streams in the eastern foothill region of the Rocky Mountains from Saskatchewan to New Mexico, and ranging east to the Dakotas, western Nebraska, Kansas, Oklahoma and Texas.

Often planted as a shade and street tree in the Rocky Mountain states; hardy in Massachusetts.

14. Populus balsamifera L. Cottonwood.

Populus angulata Michx. f.

Leaves ovate, longer than broad, abruptly acuminate and often long-pointed at apex, subcordate or rarely truncate at the wide base, finely crenately serrate with glandular teeth, furnished on the upper surface at the insertion of the petiole with two glands, thick, glabrous, green and lustrous on the upper surface, paler below, 5′–7′ long and 4′–5′ wide, with stout midribs and conspicuous primary veins sometimes sparingly pilose below early in the season; petioles much compressed laterally, often more or less tinged with red, 3′–4′ in length. **Flowers:** aments glabrous, short-stalked, the staminate densely flowered, 1½′–2′ long, ½′–¾′ in diameter, the pistillate slender, sparsely flowered, 3′–3½′ in length; scales scarious, light brown, glabrous, dilated and irregularly divided at apex into filiform lobes; disk of the staminate flower broad, oblique, slightly thickened and revolute on the margins; stamens 60 or more, with short filaments and large dark red anthers; disk of the pistillate flower broad, slightly crenate, inclosing about ⅓′ of the ovoid obtusely pointed ovary, with 3 or 4 sessile dilated lacinately lobed stigmas. **Fruit** on aments 8′–12′ in length, ellipsoidal, pointed, thin-walled, 3 or 4-valved, ½′ long, the disk little enlarged; pedicels ⅛′–¼′ in length; **seeds** oblong-obovoid, rounded at apex, light brown, about 1½′ long.

A large tree with massive spreading branches and stout yellow-brown often angular branchlets. **Winter-buds** resinous, acute, ½′ long with light chestnut brown lustrous scales.

Distribution. Shores of Lake Champlain (Shelburne Point, Chittenden County), Vermont; western New York; Island of the Delaware River above Easton, Northampton County, Pennsylvania; Baltimore County, and Bare Hills, Maryland; northern banks of

Fig. 130

the Potomac River opposite Plummer's Island near Washington, D.C.; Artesia, Lowndes County, and Starkville, Oktibbeha County, Mississippi; rare and local.

Populus balsamifera var. virginiana Sarg. Cottonwood.

Populus deltoidea Marsh. at least in part.

Populus nigra β virginiana Castiglioni.

Leaves deltoid to ovate-deltoid, acuminate with entire points, truncate, slightly cordate or occasionally abruptly cuneate at the entire base, crenately serrate above, with incurved glandular teeth, fragrant with a balsamic odor, glabrous, thick and firm, light bright green and lustrous, paler on the lower than on the upper surface, 3′–5′ long and broad, with a stout yellow midrib often tinged with red toward the base, raised and rounded on the upper side, and conspicuous primary veins; petioles slender, pilose at first, soon glabrous, compressed laterally, yellow often more or less tinged with red, $2\frac{1}{2}'$–$3\frac{1}{2}'$ long. **Flowers** and **Fruit:** as on the type.

A tree, sometimes 100° high, with a trunk occasionally 7°–8° in diameter, divided often 20°–30° above the ground into several massive limbs spreading gradually and becoming pendulous toward the ends, and forming a graceful rather open head frequently 100° across, or on young trees nearly erect above and spreading below almost at right angles with the stem, and forming a symmetrical pyramidal head, and stout branchlets marked with long pale lenticels, terete, or, especially on vigorous trees, becoming angled in their second year, with thin more or less prominent wings extending downward from the two sides and from the base of the large 3-lobed leaf-scars. **Winter-buds** very resinous, ovoid, acute, the lateral much flattened, $\frac{1}{2}'$ long, with 6 or 7 light chestnut-brown lustrous scales. **Bark** thin, smooth, light yellow tinged with green on young stems and branches, becoming on old trunks $1\frac{1}{2}'$–$2'$ thick, ashy gray, and deeply divided into broad rounded ridges broken into closely appressed scales. **Wood** dark brown, with thick nearly white sapwood, warping badly in drying and difficult to season.

Distribution. Banks of streams, often forming extensive open groves, and toward the western limits of its range occasionally in upland ravines and on bluffs; Province of Quebec and the shores of Lake Champlain, through western New England, western New York, Pennsylvania west of the Alleghany Mountains, and westward to southern Minnesota, North and South Dakota, eastern Nebraska, eastern Kansas, Oklahoma and Texas, and southward through the Atlantic states from Delaware to western Florida (valley of the Apalachicola River), and through the Gulf states to western Texas (Brown County). In the south Atlantic states and the valley of the Lower Ohio River and southward sometimes replaced by a variety with leaves covered above when they unfold with soft white hairs and below with close pubescence more or less persistent during the season especially on the midribs and veins (f. *pilosa* Sarg.).

Fig. 131

Often planted for shelter and ornament on the treeless plains and prairies between the Mississippi River and the Rocky Mountains, and as an ornamental tree in the eastern United States and largely in western and northern Europe.

× *Populus canadensis* Moench, believed to be a hybrid between the northern glabrous form of *P. balsamifera* and the European *P. nigra* L., with several varieties, is cultivated in Europe and occasionally in the United States. The best known of these varieties, × *P. canadensis* var. *Eugenie* Schelle, the Carolina Poplar of American nurseries, believed to be a hybrid of the northern Cottonwood with the Lombardy Poplar, has been planted in the United States in immense numbers.

× *Populus Jackii* Sarg., believed to be a hybrid of the northern Cottonwood with *P. tacamahacca*, with characters intermediate between those of its supposed parents, grows spontaneously near the mouth of the Chateaugay River and at Beauharnois, Province of Quebec, and at South Haven, Michigan, and is now occasionally cultivated.

15. Populus Palmeri Sarg.

Leaves thin, ovate, gradually or abruptly contracted at apex into a narrow acuminate entire point, cuneate or rounded at the broad base, finely serrate with incurved teeth, ciliate on the margins when they unfold, otherwise glabrous, $2\frac{1}{2}'$–$5'$ long and $1\frac{1}{2}'$–$2\frac{1}{4}'$ wide; petioles slender, glabrous, $1\frac{1}{2}'$–$2\frac{1}{2}'$ in length. **Flowers** not seen. **Fruit:** aments glabrous, 12–15cm. long; fruit ovoid, obtuse, slightly pitted, puberulous, thin-walled, 4-valved, $\frac{1}{4}'$–$\frac{1}{3}'$ long, the disk deeply lobed; pedicel slender, $\frac{1}{4}'$–$\frac{1}{3}'$ in length.

A tree 60° tall, with a straight trunk 3° in diameter, erect smooth pale branches forming an open pyramidal head, the lower branches smaller, horizontal or pendulous, and slender glabrous branchlets light reddish brown early in the season, becoming pale grayish brown

in their second year. **Bark** pale, 3′–4′ thick, deeply divided by wide fissures into narrow ridges.

Distribution. In moist fertile soil near springs, at the base of high chalky bluffs of

Fig. 132

Nueces Cañon of the upper Nueces River, Uvalde County, growing with *Salix nigra* var. *Lindheimeri*, *Carya pecan*, *Morus rubra* and *Ulmus crassifolia*, and at Strawn, Palo Pinto County, Texas.

2. SALIX L. Willow.

Trees or shrubs, with watery juice, scaly bark, soft wood, slender terete tough branchlets often easily separated at the joints, and winter-buds covered by a single scale of 2 coats, the inner membranaceous, stipular, rarely separable from the outer, inclosing at its base 2 minute opposite lateral buds alternate with 2 small scale-like caducous leaves coated with long pale or rufous hairs. Leaves variously folded in the bud, alternate, simple, lanceolate, obovate, rotund or linear, penniveined; petioles sometimes glandular at the apex, and more or less covering the bud, in falling leaving U-shaped or arcuate elevated leaf-scars displaying the ends of 3 small equidistant fibro-vascular bundles; stipules oblique, serrate, small and deciduous, or foliaceous and often persistent, generally large and conspicuous on vigorous young branches, leaving in falling minute persistent scars. Flowers in sessile or stalked aments, terminal and axillary on leafy branchlets; scales of the ament lanceolate, concave, rotund or obovate, entire or glandular-dentate, of uniform color or dark-colored toward the apex, more or less hairy, deciduous or persistent; disk of the flower nectariferous, composed of an anterior and posterior or of a single posterior gland-like body; stamens 3–12 or 1 or 2, inserted on the base of the scale, with slender filaments free or rarely united and usually light yellow, glabrous, or hairy toward the base, and small ovoid or oblong anthers generally rose-colored before anthesis, becoming orange or purple; ovary sessile or stipitate, conic, obtuse to subulate-rostrate, glandular at the base, glabrous, tomentose or villose, with an abbreviated style divided into 2 short recurved retuse or 2-parted stigmas; ovules 4–8 on each of the 2 placentas. Fruit an acuminate 1-celled capsule separating at maturity into 2 recurved valves. Seeds minute, narrowed at the ends, dark chestnut-brown or nearly black; cotyledons oblong.

Salix inhabits the banks of streams and low moist ground, the alpine summits of moun-

tains, and the Arctic and sub-Arctic regions of the northern hemisphere, ranging south in the New World, with a few species, through the West Indies and Central America to Brazil, and the Andes of Chili, and in the Old World to Madagascar, southern Africa, the Himalayas, Burmah, the Malay peninsula, Java, and Sumatra. Of the 160 or 170 species which are now recognized about seventy are found in North America. Of these twenty-four attain the size and habit of trees, the others being small and sometimes prostrate shrubs. Of exotic species, *Salix alba*, L., and *Salix fragilis* L., important European timber-trees, are now generally naturalized in the northeastern states. The flexible tough branches of several species are used in making baskets; the bark is rich in tannic acid and is used in tanning leather and yields salicin, a bitter principle valuable as a tonic. Many of the species are cultivated as ornamental trees.

Salix is the classical name of the Willow-tree.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT SPECIES

Scales of the flowers deciduous, pale straw color.

Stamens 3 or more.

Leaves green on both surfaces; petioles without glands at the base of the leaves; branchlets easily separable.

Branchlets reddish or grayish purple; leaves mostly narrow-lanceolate; capsule glabrous. 1. **S. nigra** (A, C, E).

Branchlets yellowish-gray; leaves lanceolate to elliptic-lanceolate; capsule often more or less pubescent. 2. **S. Gooddingii** (F, G, H).

Leaves (at least when fully grown) pale or glaucous below.

Petioles without glands.

Branchlets easily separable.

Leaves narrow-lanceolate to lanceolate; petioles less than $\frac{1}{2}'$ long. 3. **S. Harbisonii** (C).

Leaves lanceolate to ovate-lanceolate, caudate; petioles $\frac{1}{2}'$–$\frac{3}{4}'$ long. 4. **S. amygdaloides** (A, B).

Branchlets not easily separable.

Capsules short-stalked (pedicels hardly more than $\frac{1}{4}'$ long), ovoid-conic, up to $\frac{1}{3}'$ in length; leaves more or less narrow-lanceolate, petioles glabrous or nearly so. 5. **S. Bonplandiana** (H).

Capsules long-stalked (pedicels $\frac{1}{2}'$–$\frac{1}{3}'$ long), more or less acuminate.

Petioles puberulous; leaves lanceolate to ovate-lanceolate; stipules without glands on their inner surface; capsules hardly more than $\frac{1}{4}'$ long. 6. **S. lævigata** (G, F).

Petioles hairy-tomentose; leaves lanceolate; stipules glandular on their inner surface; capsules $\frac{1}{4}'$–$\frac{3}{4}'$ long. 7. **S. longipes** (C, D.)

Petioles glandular; leaves lanceolate to broadly ovate, caudate; branchlets easily separable.

Leaves distinctly pale or glaucous below, lanceolate to ovate-lanceolate. 8. **S. lasiandra** (B, G).

Leaves pale green below, ovate to elliptic-lanceolate, abruptly caudate-acuminate. 9. **S. lucida** (A).

Stamens 2.

Stigmas linear, 4 or 5 times longer than broad.

Leaves linear, hardly more than $\frac{1}{3}'$ long; anthers very small, globose; aments small, in fruit hardly up to $\frac{4}{5}'$ in length. 10. **S. taxifolia** (H).

Leaves linear-lanceolate to elliptic-lanceolate; up to 2′ in length; anthers ellipsoid; aments longer 11. **S. sessilifolia** (B, G).

Stigmas short, hardly 2 or 3 times longer than broad.

Mature leaves covered below with appressed white silky hairs, those of flowering branchlets entire or barely denticulate. 12. **S. exigua** (B, F, G).

Mature leaves glabrous below, those of flowering branchlets more or less distinctly denticulate. 13. **S. longifolia** (A, F).

Scales of the flowers persistent, dark brown or fuscous, at least toward the apex (in *S. Bebbiana* more or less straw-colored or tawny).

Stamens 2.

Ovaries glabrous.

Leaves more or less denticulate or serrate; styles short.

Base of leaf cuneate or rounded.

Leaves acute, oblanceolate to narrowly lanceolate; filaments mostly united below. 14. **S. lasiolepis** (G).

Leaves mostly acuminate; filaments free.

Branchlets glabrous, lustrous; leaves oblanceolate to narrowly obovate, up to 2′ in length; pedicels $\frac{1}{8}$′–$\frac{1}{6}$′ long; stipules small. 15. **S. Mackenzieana** (A, G).

Branchlets pubescent; leaves narrowly lanceolate to ovate-lanceolate, 4′–6′ long; pedicels 1.5–2.5 mm. long. 16. **S. missouriensis** (A).

Base of leaf mostly more or less cordate; leaves glabrous; filaments free; pedicels long. 17. **S. pyrifolia** (A).

Leaves entire, oval to broad-obovate; branchlets villose-pubescent during their first season. 18. **S. amplifolia.**

Ovaries pubescent (glabrous often in No. 23).

Leaves covered with a soft dense felt-like tomentum, oblong-lanceolate to elliptic-lanceolate. 19. **S. alaxensis** (B).

Leaves glabrous or more or less villose-pubescent below.

Bracts of the flowers pale or tawny, often reddish at the tip; pedicels up to $\frac{1}{5}$′ in length; leaves elliptic-lanceolate to obovate, reticulate beneath in age, pubescent or glabrate. 20. **S. Bebbiana.**

Bracts of the flowers brown or fuscous.

Stipules more or less distinctly developed; pedicels several times longer than the short styles.

Leaves elliptic-lanceolate to oblong-elliptic; mostly glabrous in age. 21. **S. discolor** (A, B, F).

Leaves oblanceolate to cuneate-obovate, covered beneath with short hairs or at maturity with a gray villose-pubescence. 22. **S. Scouleriana** (A, B).

Stipules usually wanting; pedicels hardly longer than the distinct styles; leaves broad-elliptic to obovate-oblong, more or less grayish villose beneath. 23. **S. Hookeriana** (B, G).

Stamens usually 1; leaves obovate-oblong, densely covered below with lustrous silvery white silky tomentum. 24. **S. sitchensis** (B, G).

1. Salix nigra Marsh. Black Willow.

Leaves lanceolate, long-acuminate, often falcate, gradually cuneate or rounded at base, finely serrate, thin bright light green, rather lustrous, with obscure reticulate veins, glabrous or often pubescent on the under side of the midribs and veins and on the short slender petioles, 3′–6′ long, $\frac{1}{8}$′–$\frac{3}{4}$′ wide; at the north turning light yellow before falling in the autumn; stipules semicordate, acuminate, foliaceous, persistent, or ovoid, minute, and deciduous. **Flowers:** aments terminal on leafy pubescent branches, narrowly cylindric, 1′–3′ long; scales yellow, elliptic to obovate, rounded at apex and coated on the inner surface with pale hairs; stamens 3–5, with filaments hairy toward the base; ovary ovoid, short-stalked, glabrous, gradually narrowed above the middle to the apex, with nearly sessile slightly divided stigmatic lobes. **Fruit** ovoid-conic, short-stalked, glabrous, about $\frac{1}{8}$′ long, light reddish brown.

A tree, usually 30°–40° high, with usually several clustered stout stems, thick spreading upright branches forming a broad somewhat irregular open head, and reddish brown or gray-brown branchlets pubescent when they first appear, soon glabrous, and easily separated at the joints. **Winter-buds** acute, about $\frac{1}{8}'$ long. **Bark** $1'$–$1\frac{1}{4}'$ thick, dark brown or nearly black and deeply divided into broad flat connected ridges separating freely into

Fig. 133

thick plate-like scales and becoming shaggy on old trunks. **Wood** light, soft, weak, light reddish brown, with thin nearly white sapwood ; now sawed into lumber in the valley of the lower Mississippi River and largely used for packing cases, cellar and barn floors, in furniture, and in the manufacture of toys and other purposes where strength is not important as it does not warp, check or splinter.

Distribution. Low moist alluvial banks of streams and lakes; southern New Brunswick through southern Quebec and Ontario to the region north of Lake Superior, southward to northern and western North Carolina, through the Piedmont region of South Carolina and Georgia to eastern and central Alabama, and westward to southeastern North Dakota, eastern South Dakota, Nebraska, Kansas, the valley of Wichita River, Oklahoma, and central and western Texas to Valverde County.

In southern Arkansas, in Louisiana and in eastern Texas *Salix nigra* is often replaced by var. *altissima* Sarg., differing from the type in the more pubescent young branchlets, leaves and petioles, in the more acute base of the leaves and longer petioles, and in its later flowering. A tree sometimes 120 feet high and the tallest of American Willows.

Salix nigra var. Lindheimeri Schn.

Salix Wrightii Sarg. not Anders.

Leaves lanceolate, often slightly falcate, long-pointed and acuminate at apex, cuneate at base, finely glandular-serrate, glabrous, light green on the upper surface, paler below, $4'$–$5'$ long, $\frac{1}{3}'$–$\frac{1}{2}'$ wide; petioles pubescent early in the season, becoming glabrous, $\frac{1}{2}'$–$\frac{3}{4}'$ in length. **Flowers:** aments slender, densely villose, $2'$–$3'$ long; scales ovate, acute or rarely rounded at apex, covered with matted white hairs, more abundant on the inner surface; stamens 4 or 5; filaments villose below the middle; ovary ovoid, gradually narrowed to the apex, the 2-lobed stigmas nearly sessile. **Fruit** ovoid-conic; pedicels about $\frac{1}{4}'$ long.

A tree, 50°–70°, high with a trunk often 3° in diameter, large erect spreading branches forming an open irregular head, and slender branchlets light green and slightly pubescent

when they first appear, becoming light orange or yellow-brown and lustrous. **Bark** thick, pale yellow-brown, deeply furrowed, the surface sometimes separating into long plate-like scales.

Fig. 134

Distribution. River banks, central and western Texas from Grayson and Dallas Counties and the lower valley of the Brazos River to the valleys of the San Antonio and upper Guadalupe Rivers; in Coahuila, Nuevo Leon and Tamaulipas.

2. Salix Gooddingii Ball.

Salix vallicola Britt.

Leaves lanceolate to narrow elliptic-lanceolate, acute or acuminate, acutely cuneate at base, finely glandular-serrate, often slightly falcate, silky pubescent when they unfold especially below, glabrous and dull green at maturity, $1\frac{1}{2}'$–$3'$ long, $\frac{1}{4}'$–$\frac{1}{2}'$ wide, or on vigorous shoots $5'$ or $6'$ long and $\frac{3}{4}'$ wide; petioles pubescent, usually becoming glabrous, $\frac{1}{6}'$–$\frac{1}{4}'$ in

Fig. 135

length; stipules orbicular-cordate, coarsely glandular-serrate, pubescent. **Flowers:** aments pubescent terminal on leafy pubescent branchlets, narrow-cylindric, 1′–2′ long; scales linear-oblanceolate, acute, yellow, hoary tomentose; stamens 3–5; filaments villose toward the base; ovary ovoid-conic, gradually narrowed to the acuminate apex, pubescent or glabrous; style distinct, 2-lobed. **Fruit** ovoid, acute, light reddish brown, glabrous or pubescent, $\frac{1}{4}'$ long; pedicels glabrous or rarely pubescent, $\frac{1}{16}'$–$\frac{1}{8}'$ in length.

A tree, 25°–50° high, with slender light orange-colored or grayish glabrous or pubescent easily separable branchlets. **Bark** rough, thick, deeply furrowed, sometimes nearly black.

Distribution. River banks: Reed Creek, Shasta County, and Red Bluff, Tehama County, California, southward in the interior valleys and on the western foothills of the Sierra Nevada to the mountain valleys in the southern part of the state, and to northern Lower California; eastward through central and southern Arizona; in southeastern Nevada; through southern New Mexico to western Texas (El Paso, El Paso County, and Fort Davis, Jeff Davis County); and southward into northern Mexico.

3. Salix Harbisonii Schn.

Leaves linear-lanceolate, narrow-elliptic or rarely obovate-lanceolate, acute or short-acuminate, obtusely or acutely cuneate at the base, and finely glandular dentate; when the flowers open more or less pubescent especially below or glabrous, and at maturity green on

Fig. 136

the upper surface, pale on the lower surface, glabrous, 4′ or 5′ long, $\frac{3}{4}'$ broad; petioles villose early in the season, becoming glabrous, $\frac{1}{4}'$ in length, minutely glandular at apex; stipules wanting or minute, semicordate, acute, pubescent on vigorous leading branches and sometimes $\frac{1}{4}'$ long. **Flowers:** aments terminal on leafy branchlets, $2\frac{1}{2}'$–3′ in length, their rachis villose-pubescent; scales ovate or ovate-oblong, obtuse or acute; stamens usually 5–7, rarely 3–9; filaments densely villose; ovary ovoid, long-acuminate, glabrous, long-stalked; style short, distinct, 2-lobed. **Fruit** acuminate and long-pointed, acute at base, $\frac{1}{4}'$ long and about as long as its pedicel.

A tree, 30°–50° high, with a trunk 10′ or 12′ in diameter, with often pendulous branches, and slender branchlets more or less densely pubescent or tomentose or nearly glabrous when they first appear, becoming glabrous and dark reddish purple in their second season,

and easily separable at the joints; often only a large shrub. **Bark** thick, deeply furrowed, dark red-brown, separating on the surface into small appressed scales.

Distribution. River banks and the borders of swamps; Dismal Swamp, Norfolk County, Virginia; near Goldsboro, Wayne County, North Carolina; common in the coast region of South Carolina and Georgia, extending up the Savannah River at least as far as Augusta, Richmond County, and through southern Georgia to the valley of the Flint River; swamps near Jacksonville, Duval County, and in the neighborhood of Apalachicola, Florida.

4. Salix amygdaloides Anders. Peach Willow. Almond Willow.

Leaves lanceolate to ovate-lanceolate, frequently falcate, gradually or abruptly narrowed into a long slender point, cuneate or gradually rounded and often unequal at base, finely serrate, slightly puberulous when they unfold, becoming at maturity thin and firm in texture, light green and lustrous above, pale and glaucous below, $2\frac{1}{2}'$–$4'$ long, $\frac{3}{4}'$–$1\frac{1}{4}'$ wide, with a stout yellow or orange-colored midrib, prominent veins and reticulate veinlets; petioles slender, nearly terete $\frac{1}{2}'$–$\frac{3}{4}'$ in length; stipules reniform, serrate, often $\frac{1}{2}'$ broad on vigorous shoots, usually caducous. **Flowers:** aments on leafy branchlets, elongated, cylindric, slender, arcuate, stalked, pubescent or tomentose, 2′–3′ long; scales yellow, sparingly villose on the outer, densely villose on the inner face, the staminate broadly ovate, rounded

Fig. 137

at the apex, the pistillate oblong-obovate, narrower, caducous; stamens 5–9, with free filaments slightly hairy at the base; ovary oblong-conic, long-stalked, glabrous, with a short style and emarginate stigmas. **Fruit** globose-conic, light reddish yellow, about $\frac{1}{4}'$ in length.

A tree, sometimes 60°–70° high, with a single straight or slightly inclining trunk rarely more than 2° in diameter, straight ascending branches, and slender glabrous or rarely pilose (f. *pilosiuscula* Schn.) branchlets marked with scattered pale lenticels, dark orange color or red-brown and lustrous, becoming in their first winter light orange-brown. **Winter-buds** broadly ovoid, gibbous, dark chestnut-brown, very lustrous above the middle, light orange-brown below, $\frac{1}{8}'$ long. **Bark** $\frac{1}{2}'$–$\frac{3}{4}'$ thick, brown somewhat tinged with red, and divided by irregular fissures into flat connected ridges separating on the surface into thick plate-like scales. **Wood** light, soft, close-grained, light brown, with thick nearly white sapwood.

Distribution. Banks of streams; Province of Quebec from the neighborhood of Montreal to Winnipeg, and along the fiftieth degree of north latitude to southeastern British Columbia, and to central New York, along the southern shores of Lake Erie, and through northern Ohio to northern Indiana, southwestern Illinois, northern and central Missouri, and to

Kansas, northwestern Oklahoma and northwestern Texas; in Colorado, Utah and Nevada to central Oregon and southeastern Washington.

Salix amygdaloides var. Wrightii Schn.

Salix Wrightii Anders.

Leaves lanceolate, gradually acuminate and long-pointed at apex, cuneate at base, finely serrate, occasionally slightly falcate, glabrous, yellow-green on the upper surface, pale on the lower surface, $1\frac{1}{2}'$–$2'$ long, $\frac{1}{4}'$–$\frac{1}{3}'$ wide, and on vigorous summer shoots sometimes $4'$ or $5'$ long and $\frac{1}{2}'$ wide; petioles slender, glabrous, $\frac{1}{4}'$–$\frac{1}{3}'$ in length. **Flowers** and **Fruit** as in the species.

Fig. 138

A small or large tree best distinguished from *S. amygdaloides* by the distinctly yellow or yellowish brown glabrous branchlets.

Distribution. Barstow, Ward County, common along the Rio Grande near El Paso and at Belon, El Paso County, and on Amarillo Creek, Potter County, western Texas; through southern New Mexico to the Sacramento Mountains, Otero County.

5. Salix Bonplandiana var. Toumeyi Schn.

Salix Toumeyi. Britt.

Leaves $4'$–$6'$ long, $\frac{1}{2}'$–$\frac{3}{4}'$ wide, linear-lanceolate to oblong-lanceolate, acuminate with a long slender point at apex, gradually narrowed and often unequal at the cuneate base, obscurely serrate with glandular teeth, or entire with revolute margins, thick and firm, reticulate-venulose, yellow-green and lustrous above, silvery white below, with a broad yellow midrib; falling irregularly during the winter; petioles stout, grooved, reddish; stipules ovate, rounded, slightly undulate, thin and scarious, $\frac{1}{8}'$–$\frac{1}{4}'$ broad, often persistent during the summer. **Flowers:** aments on leafy branchlets, cylindric, erect, slender, short-stalked, the staminate $1'$–$1\frac{1}{2}'$ long and somewhat longer than the pistillate; scales broadly obovate, rounded at the apex, light yellow, villose on the outer surface and glabrous or slightly hairy above the middle on the inner surface; stamens usually 3, with free filaments slightly hairy at the base; ovary slender, oblong-conic, short-stalked, glabrous, with nearly sessile much-thickened club-shaped stigmas, sometimes nearly encircled below by the large broad ventral gland. **Fruit** ovoid-conic, rounded at base, light reddish yellow.

A tree, rarely more than 30° high, with a trunk $12'$–$15'$ in diameter, slender erect and spreading branches often pendulous at the ends, forming a broad round-topped head, and

slender glabrous branchlets marked with occasional pale lenticels, light yellow, becoming light or dark red-brown and lustrous, and paler orange-brown in their second year. **Winter-buds** narrowly ovoid, long-pointed, more or less falcate, bright red-brown, lustrous, $\frac{1}{4}'$ long. **Bark** $\frac{1}{2}'$–$\frac{3}{4}'$ thick, dark brown or nearly black, and deeply divided by narrow fissures into broad flat ridges separating on the surface into closely appressed scales.

Fig. 139

Distribution. Banks of streams in the cañons of the mountains of central and southern Arizona (Sycamore Cañon near Flagstaff and Sabino Cañon, Santa Catalina Mountains); and southwestern New Mexico (cañon, Saint Louis Mountains, Grant County); in Chihuahua, Sonora and Lower California.

The typical *S. Bonplandiana* H. B. K. with broader and more coarsely serrate leaves, and flower-aments appearing from July to January from the axils of mature leaves is widely distributed in Mexico and ranges to Guatemala.

6. Salix lævigata Bebb. Red Willow.

Leaves obovate, narrowed and rounded or acute and mucronate at apex, cuneate at base, with slightly revolute obscurely serrate margins, on sterile branches lanceolate or oblong-

Fig. 140

lanceolate, acute or acuminate, when they unfold light blue-green and coated on the lower surface with long pale or tawny deciduous hairs, at maturity glabrous, dark blue-green and lustrous above, paler and glaucous below, 3′–7′ long, ¾′–1½′ wide, with a broad flat yellow midrib; petioles broad, grooved, puberulous, rarely ½′ long; stipules ovate, acute, finely serrate, usually small and caducous. **Flowers:** aments cylindric, slender, lax, elongated, 2′–4′ long, on leafy branchlets; scales peltate, dentate at apex, covered with long pale hairs, the staminate obovate, rounded, the pistillate narrower and more or less truncate; stamens usually 5 or 6, with free filaments hairy at the base; ovary conic, acute, rounded below, short-stalked, glabrous, with broad spreading emarginate stigmatic lobes. **Fruit** elongated, conic, long-stalked, nearly ¼′ in length.

A tree, 40°–50° high, with a straight trunk 2° in diameter, slender spreading branches, and slender light or dark orange-colored or bright red-brown glabrous, or in one form tomentose or villose (f. *araquipa* Jeps.) branchlets; often much smaller, with an average height of 20°–30°. **Winter-buds** ovoid, somewhat obtuse, pale chestnut-brown, ⅛′–¼′ long. **Bark** ¾′–1′ thick, dark brown slightly tinged with red and deeply divided into irregular connected flat ridges broken on the surface into thick closely appressed scales. **Wood** light, soft, light brown tinged with red, with thick nearly white sapwood.

Distribution. Banks of streams; western California from the Oregon boundary to the southern borders of the state, ascending to altitudes of 4500° on the western slopes of the southern Sierra Nevada, and eastward to Mohave and Yavapai Counties, Arizona, southeastern Nevada and southwestern Utah.

7. Salix longipes Shuttl.

Salix amphibia Small.

Leaves lanceolate, acuminate or on fertile branches occasionally rounded at the apex, rounded or cuneate at the base, finely serrate, hoary-tomentose early in the season, becoming glabrous above, and pale and glabrous or pubescent below, 2′–4′ long, ½′–¾′ wide; petioles hoary-tomentose, ¼′–½′ long; stipules minute, ovate, acute, hoary-tomentose, caducous, on vigorous shoots foliaceous, reniform, serrate above the middle, often ¾′ in diameter. **Flowers:** aments terminal on leafy tomentose or glabrous branchlets, narrow-cylindric, 3′ or 4′ long; scales ovate, rounded at the apex, yellow, densely villose-pubescent; stamens 3–7, usually 5 or 6, the filaments hairy toward the base; ovary ovoid-conic, acute, cuneate at the base with a short 2-lobed style, and pedicels up to ¼′ in length. **Fruit** ovoid, often rather abruptly contracted above the middle, ¼′ in length.

Fig. 141

A tree, 20°–30°, high with a trunk occasionally 12′–18′ in diameter, spreading branches, and glabrous or pubescent red-brown or gray-brown branchlets; or more often a shrub. **Bark** dark, sometimes nearly black, deeply divided into broad ridges covered by small closely appressed scales.

Distribution. Borders of swamps and streams; coast of North Carolina southward to the Everglade Keys of Florida, ranging westward in Florida to the valley of the Saint Marks River, Wakulla County; in Cuba.

A variety with narrower summer leaves and longer petioles is var. *venulosa* Schn.

Distribution. Newbern, Craven County, North Carolina, southward near the coast to northern and western Florida, ranging inland in Georgia to the banks of the Savannah River near Augusta, Richmond County, and to Traders Hill, Charlton County; in the neighborhood of New Orleans, Louisiana (*Drummond*); in southwestern Oklahoma and in western Texas (Blanco, Kendall, Kerr, Bandera and Uvalde Counties).

A variety with obtuse stipules, usually glabrous branchlets and lanceolate or narrow elliptic-lanceolate leaves is distinguished as var. *Wardii* Schn.

A shrub or small tree.

Distribution. Banks of the Potomac River, District of Columbia, and Alleghany County, Maryland to Natural, Rockbridge, Fairfax and Elizabeth Counties, Virginia; northern Kentucky; northern Tennessee; northeastern Mississippi (near Iuka, Tishomingo County); St. Clair and Madison Counties, Illinois; more abundant in Missouri from Pike County southward to southwestern Kansas, western Arkansas and eastern Oklahoma.

8. Salix lasiandra Benth. Yellow Willow.

Leaves lanceolate to ovate-lanceolate, acuminate and long-pointed at apex, cuneate or rounded at base, often slightly falcate, finely serrate, glabrous, dark green and lustrous above, pale or glaucous below, 1½′–3′ long, about ½′ wide, on vigorous summer shoots often

Fig. 142

6′ or 7′ long and 1½′ wide; petioles slender, glabrous, glandular at apex, ¼′ in length, or on summer shoots stout and 1′–1½′ long; stipules reniform, caducous. **Flowers:** aments terminal on leafy puberulous branchlets, narrow-cylindric, 2½′–3′ in length; scales pale pubescent, those of the staminate ament lanceolate-acuminate to obovate and rounded at apex and entire, those of the pistillate ament obovate and usually dentate near the apex; stamens 5–9; filaments hairy below the middle; ovary rather abruptly narrowed above the middle and acuminate, long-stalked; style short with slightly emarginate lobes. **Fruit** light red-brown, ¼′ long; pedicels about $\frac{1}{16}$′ in length.

A tree often 60° in height with a trunk 2°–3° in diameter, or sometimes shrubby, and with straight ascending branches and rather stout branchlets, at first dark purple, reddish brown, or yellow, pilose with scattered hairs or pubescent or tomentose, and often covered by glaucous bloom, becoming dark purple, bright reddish brown or bright orange color. Winter-buds broadly ovate, acute, light chestnut brown and lustrous above the middle, pale at base, and nearly $\frac{1}{4}'$ in length. Bark $\frac{1}{2}'$–$\frac{3}{4}'$ thick, dark brown, slightly tinged with red, and divided by shallow fissures in broad flat scaly ridges broken by cross fissures into oblong plates.

Distribution. Valley of the Yukon River near Dawson, Yukon, Vancouver Island, and southward near the coast of Washington and Oregon, and on the western slope of the Sierra Nevada and on the coast ranges to southern California, ranging from the sea-level to altitudes of 8500° on the southern Sierra Nevada; in New Mexico (Glenwood, Soccoro County, and Santa Fé, Santa Fé County); in Colorado (Buena Vista, Chaffee County, *Alice Eastwood*). Passing into var. *caudata* Sudw., distinguished by its caudate-acuminate leaves green on both surfaces, and by its bright yellow or orange-yellow branchlets, and ranging from northeastern Oregon and eastern Washington through Idaho, and from northern Wyoming to southern Colorado, Utah and Nevada.

A variety (var. *lancifolia* Bebb), differing from the typical *S. lasiandra* in the gray or rusty villose pubescence covering the branchlets during their first and sometimes their second season and the lower surface of the young leaves, is distributed from Dawson in the valley of the Yukon River southward to the valley of the upper Nesqually River, Washington, to the valley of the Willamette River (Salem, Oregon), to Santa Cruz, Santa Cruz County, and to the San Bernardino Mountains, California.

9. Salix lucida Muehl. Shining Willow.

Leaves ovate-lanceolate, or narrow lanceolate (f. *angustifolia* Anders.), acuminate and long-pointed at apex, cuneate or rounded at base, finely serrate, 3′–5′ long, 1′–$1\frac{1}{2}'$ wide, covered when they unfold with scattered pale caducous hairs, at maturity coriaceous, smooth and lustrous, dark green above, paler below, with a broad yellow midrib, and slender

Fig. 143

primary veins arcuate and united near the margins; petioles stout, yellow, puberulous, glandular at the apex, with several dark or yellow conspicuous glands, $\frac{1}{4}'$–$\frac{1}{2}'$ long; stipules nearly semicircular, glandular-serrate, membranaceous, $\frac{1}{8}'$–$\frac{1}{4}'$ wide, often persistent during the summer. **Flowers:** aments erect, tomentose, on stout puberulous peduncles terminal

on short leafy branchlets, the staminate oblong-cylindric, densely flowered, about $1\frac{1}{2}'$ in length, the pistillate slender, elongated, $1\frac{1}{2}'$–$2'$ long, often persistent until late in the season; scales oblong or obovate, rounded, entire, erose or dentate at apex, light yellow, nearly glabrous or coated on the outer surface with pale hairs, often ciliate on the margins; stamens usually 5, with elongated free filaments slightly hairy at base; ovary narrowly cylindric, long-stalked, elongated, glabrous, with nearly sessile emarginate stigmas. **Fruit:** cylindric, lustrous, about $\frac{1}{3}'$ long.

A tree, occasionally 25° high, with a short trunk 6′–8′ in diameter, erect branches forming a broad round-topped symmetrical head, and stout glabrous branchlets dark orange color and lustrous in their first season, becoming darker and more or less tinged with red the following year; usually smaller and shrubby in habit. **Winter-buds** narrowly ovoid, acute, light orange-brown, lustrous, about $\frac{1}{4}'$ long. **Bark** thin, smooth, dark brown slightly tinged with red.

Distribution. Banks of streams and swamps; Newfoundland to the shores of Hudson's Bay and northwestward to the valley of the Mackenzie River and the eastern base of the Rocky Mountains, southward to southern Pennsylvania, northeastern Iowa, the Turtle Mountains, North Dakota, and eastern Nebraska; very abundant at the north, rare southward; a variety from extreme northeastern New England and adjacent New Brunswick and Quebec (var. *intonsa* Fernald) is distinguished by its often linear leaves rufous pubescent during the season on the under side of the veins and by its pubescent branchlets; a shrub or tree up to 25°.

10. Salix taxifolia H. B. K.

Leaves linear-lanceolate, narrowed at the ends, acute, slightly falcate, mucronate at the apex, entire or rarely obscurely dentate above the middle, coated as they unfold with long

Fig. 144

soft white hairs, at maturity pale gray-green, slightly puberulous, $\frac{1}{3}'$–$1\frac{1}{3}'$ long, $\frac{1}{12}'$–$\frac{1}{8}'$ wide, with a slender midrib, thin arcuate veins, and thickened slightly revolute margins; petioles stout, puberulous, rarely $\frac{1}{12}'$ long; stipules ovate, acute, scarious, minute, caducous. **Flowers:** aments densely flowered, oblong-cylindric or subglobose, $\frac{1}{4}'$–$\frac{1}{2}'$ long, terminal, or terminal and axillary on the staminate plant, on short leafy branchlets; scales oblong or obovate, rounded or acute and sometimes apiculate at apex, coated on the outer surface with hoary tomentum and pubescent or glabrous on the inner; stamens 2, with free filaments hairy below the middle; ovary ovoid-conic, short-stalked or subsessile, villose, with

nearly sessile deeply emarginate stigmas. **Fruit** cylindric, long-pointed, bright red-brown, more or less villose, short-stalked, about $\frac{1}{4}'$ long.

A tree, often 40°–50° high, with a trunk 18′ in diameter, erect and drooping branches forming a broad open head, and slender branchlets covered during their first season with hoary tomentum, becoming light reddish or purplish brown and much roughened by the elevated persistent leaf-scars. **Winter-buds** ovoid, acute, dark chestnut-brown, puberulous, about $\frac{1}{16}'$ long and nearly as broad as long. **Bark** of the trunk $\frac{3}{4}'$–1′ thick, light gray-brown, and divided by deep fissures into broad flat ridges covered by minute closely appressed scales.

Distribution. Near El Paso, Texas; southwestern New Mexico, and along mountain streams in southern Arizona; southward through Mexico to Guatemala, and on the Sierra de la Victoria, Lower California.

11. Salix sessilifolia Nutt.

Leaves linear-lanceolate to elliptic-lanceolate, acute or acuminate at apex, cuneate at base, entire or furnished above the middle with a few remote apiculate glandular teeth, bluish green and thickly covered with silky white hairs most abundant on the lower side of the midrib, 1′–2′ long, $\frac{1}{2}'$–$\frac{3}{4}'$ wide, or on vigorous summer shoots often 4′ long and $1\frac{1}{4}'$ wide; petioles densely villose-pubescent, $\frac{1}{16}'$–$\frac{1}{8}'$ in length; stipules ovate to lanceolate, acute, entire or denticulate. **Flowers:** aments appearing after the leaves, terminal on leafy branchlets, densely hoary-tomentose, $1\frac{1}{2}'$–$2\frac{1}{2}'$ long; scales broadly elliptic, acute or rounded

Fig. 145

at apex, cuneate at base, densely villose-tomentose; stamens 2; filaments villose below the middle; ovary sessile, villose, the stigmas sessile, deeply 2-lobed. **Fruit** ovoid-acuminate, densely villose, pubescent.

A shrub or small tree occasionally 20° high, with short hairy tomentose branchlets.

Distribution. River banks, southwestern British Columbia; Whitcomb County, Washington, and on the Umpqua and Willamette Rivers, western Oregon. Southward passing into

Var. *Hindsiana* Anders., a large shrub with numerous stems often 20° high, differing in its more linear or narrow lanceolate usually entire leaves on longer petioles, smaller aments and pubescent, not tomentose, branchlets; and distributed from the valleys of central California to southwestern Oregon. A shrubby form of *S. sessilifolia* (var. *leucodendroides* Schn.) with longer and broader leaves is common on the banks of streams in southern California.

12. Salix exigua Nutt.

Leaves lanceolate to oblanceolate, acuminate at the ends, often slightly falcate, minutely glandular-serrate above the middle, bluish green and glabrous above, covered below with appressed silky white hairs, 1½′–3′ long, ⅛′–¼′ wide, or on summer shoots sometimes 4½′ long and 1½′ wide; petioles glabrous, $\frac{1}{16}$′ long or less; stipules minute or wanting. **Flowers:** aments terminal and solitary or terminal and axillary, on leafy glabrous branchlets, 1′–2′ in length; scales hoary pubescent, lanceolate and acute on staminate aments, often wider, obovate and rounded at the apex on pistillate aments; stamens, 2, filaments hairy below the middle; ovary sessile, villose, the stigmatic lobes sessile. **Fruit** ovoid, acuminate, glabrous.

A shrub with stems 10° or 12° tall, or rarely a tree 25° high, with a trunk 5′ or 6′ in diameter, thin spreading branches forming a round-topped head, and slender glabrous red-brown branchlets. **Bark** of the trunk thin, longitudinally fissured, grayish brown.

Fig. 146

Distribution. Southern Alberta and valley of the Fraser River (Clinton), British Columbia, southward through western Washington and Oregon to San Diego County, California, and southeastern Nevada, and eastward to southern Idaho, central Nevada and western Wyoming (Yellowstone National Park).

Apparently only truly a tree on the banks of the Palouse and other streams of eastern Washington.

Several shrubby forms of *S. exigua* found in Nevada, Arizona, Colorado, western Nebraska and in Lower California are distinguished.

13. Salix longifolia Muehl. Sand Bar Willow.

Salix fluviatalis Sarg. not Nutt.

Leaves linear-lanceolate, often somewhat falcate, gradually narrowed at the ends, long-pointed, dentate with small remote spreading callous glandular teeth, 2′–6′ long, ⅛′–⅓′ wide, when they unfold coated below with soft lustrous silky hairs, at maturity thin, glabrous, light yellow-green, darker on the upper than on the lower surface, with a yellow midrib, slender arcuate primary veins, and slender reticulate veinlets; petioles grooved, ⅛′–¼′ long; stipules ovate-lanceolate, foliaceous, about ¼′ long, deciduous. **Flowers:** aments cylindric on leafy branchlets, pubescent, the staminate about 1′ long, ⅓′ broad, terminal and axillary, the pistillate elongated, 2′ or 3′ long, about ¼′ broad; scales obovate-oblong, entire, erose or dentate above the middle, light yellow-green, densely villose on the outer

surface, slightly hairy on the inner; stamens 2, with free filaments slightly hairy at the base; ovary oblong-cylindric, acute, short-stalked, glabrous or pubescent, with large sessile deeply lobed stigmas. **Fruit** light brown, glabrous or villose, about $\frac{1}{4}'$ long.

A tree, usually about 20° high, with a trunk only a few inches in diameter, spreading by stoloniferous roots into broad thickets, short slender erect branches, and slender glabrous light or dark orange-colored or purplish red branchlets, growing darker after their first season; occasionally 60°–70° high, with a trunk 2° in diameter; often a shrub not more than 5°–6° tall. **Winter-buds** narrowly ovoid, acute, chestnut-brown, about $\frac{1}{8}'$ long. **Bark** $\frac{1}{8}'$–$\frac{1}{4}'$ thick, smooth, dark brown slightly tinged with red and covered with small closely appressed irregularly shaped scales. **Wood** light, soft, light brown tinged with red, with thin light brown sapwood.

Distribution. River banks, sand bars and alluvial flats; shores of Lake St. John, Quebec to Manitoba, and southward through western New England to northeastern Virginia, southern Ohio, Indiana and Illinois, western Kentucky, south Tennessee, to the mouth of the Mississippi River, and westward to southwestern South Dakota, southwestern Wyoming, northeastern Colorado, western Kansas and Oklahoma, and northern Texas.

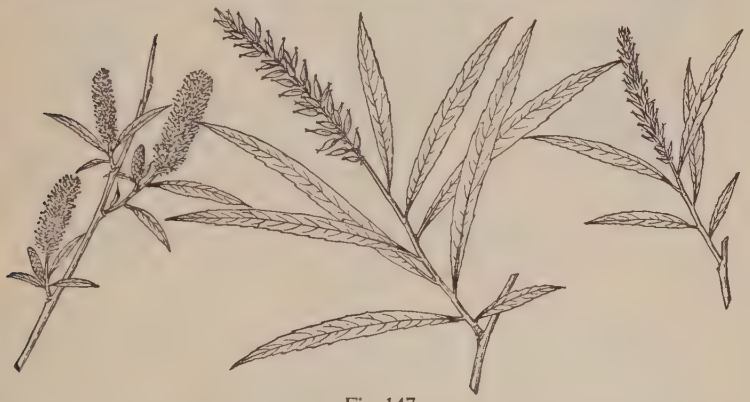

Fig. 147

From central and northwestern Texas to northeastern Mexico and southern New Mexico represented by var. *angustissima* Anders., differing in the absence of a dorsal gland in the male flowers and in the silky pubescence of the young ovary.

In the northern Rocky Mountains region replaced by var. *pedunculata* Anders., differing from the type in its narrower linear leaves, glabrous ovaries and longer pedicels of the fruit, and ranging from western South Dakota and northwestern Wyoming, through eastern Montana, Saskatchewan, and Alberta, to the valley of the Yukon River in the neighborhood of Dawson.

A shrubby form with leaves densely covered with silky pubescence (var. *Wheeleri* Schn.) is distributed from New Brunswick to North Dakota, Nebraska and Beckham County, Oklahoma.

14. Salix lasiolepis Benth. Arroyo Willow.

Leaves oblanceolate to lanceolate-oblong, often inequilateral and occasionally falcate, acute or acuminate or rarely rounded at apex, gradually or abruptly cuneate or rounded at base, entire or remotely serrate, pilose above and coated below with thick hoary tomentum when they unfold, at maturity thick and subcoriaceous, conspicuously reticulate-venulose, dark green and glabrous above, pale or glaucous and pubescent or puberulous below, 3′–6′ long, $\frac{1}{2}'$–1′ wide, with a broad yellow midrib and slender arcuate veins forked and united

within the slightly thickened and revolute margins; petioles slender, $\frac{1}{8}'$–$\frac{1}{2}'$ long; stipules ovate, acute, coated with hoary tomentum, minute and caducous, or sometimes foliaceous, semilunar, acute or acuminate, entire or denticulate, dark green above, pale below, persistent. **Flowers:** aments erect, cylindric, slightly flexuose, densely flowered, nearly sessile on short tomentose branchlets, $1\frac{1}{2}'$ long, the staminate $\frac{1}{2}'$ thick, and nearly twice as thick as the pistillate; scales oblong-obovate, rounded or acute at the apex, dark-colored, clothed with long crisp white hairs, persistent under the fruit; stamens 2, with elongated glabrous filaments more or less united below the middle; ovary narrow, cylindric acute and long-pointed, dark green, glabrous, with a short style and broad nearly sessile stigmas. **Fruit** oblong-cylindric, light reddish brown, about $\frac{1}{4}'$ long.

A tree, 20°–35° high, with a trunk 3′–7′ in diameter, slender erect branches forming a loose open head, and stout branchlets coated at first with hoary tomentum, bright yellow or dark reddish brown and puberulous or pubescent during their first year, becoming darker

Fig. 148

and glabrous in their second season; or often at the north and at high altitudes a low shrub. **Winter-buds** ovoid, acute, compressed, contracted laterally into thin wing-like margins, light brownish yellow, glabrous or puberulous. **Bark** on young stems and on the branches thin, smooth, light gray-brown, becoming on old trunks dark, about $\frac{1}{3}'$ thick, roughened by small lenticels and broken into broad flat irregularly connected ridges. **Wood** light, soft, close-grained, light brown, with thick nearly white sapwood; in southern California often used as fuel.

Distribution. Banks of streams in low moist ground; valley of the Klamath River, California, southward along the foothills of the Sierra Nevada, the central valley, and on the Coast Ranges to southern California; on Santa Catalina Island and on the mountains of southern Arizona; on the Sierra de Laguna, Lower California; occasionally ascending to altitudes of 4000° above the sea.

15. Salix Mackenzieana Barr.

Leaves lanceolate to oblanceolate, or elliptic, long-pointed at apex, cuneate or rounded at base, finely crenately serrate, reddish and pilose with caducous pale hairs when they unfold, at maturity thin and firm in texture, light green above, pale below, $1\frac{1}{2}'$–$2'$ long, about $\frac{1}{2}'$–$\frac{3}{4}'$ wide, on summer shoots, often 4′ long and $1\frac{1}{2}'$ wide, with a slender yellow midrib, arcuate veins, and obscure reticulate veinlets; petioles thin, yellow, about $\frac{1}{3}'$ long; stipules reniform, conspicuously veined, about $\frac{1}{16}'$ broad. **Flowers:** aments densely flowered, glabrous, erect, often more or less curved, about $1\frac{1}{2}'$ long, terminal on short leafy branchlets; scales oblanceolate, acute, dark-colored; stamens 2, with elongated free glabrous filaments;

ovary cylindric, long-stalked, elongated, gradually narrowed into a short style, with spreading emarginate stigmas. **Fruit** ovoid, acuminate, light brown, about $\frac{1}{8}'$ long; pedicels about $\frac{1}{8}'$ in length.

A small tree, with a slender trunk, upright branches forming a narrow shapely head, and slender branchlets marked with scattered lenticels, glabrous or slightly puberulous and often tinged with red when they first appear, soon becoming yellow and lustrous, growing lighter colored in their second year. **Winter-buds** ovoid, rounded on the back, compressed and acute at the apex, bright orange color, about $\frac{1}{8}'$ long.

Distribution. Borders of streams and swamps; shores of Great Slave Lake southward through the region at the eastern base of the Rocky Mountains to Saskatchewan, northern

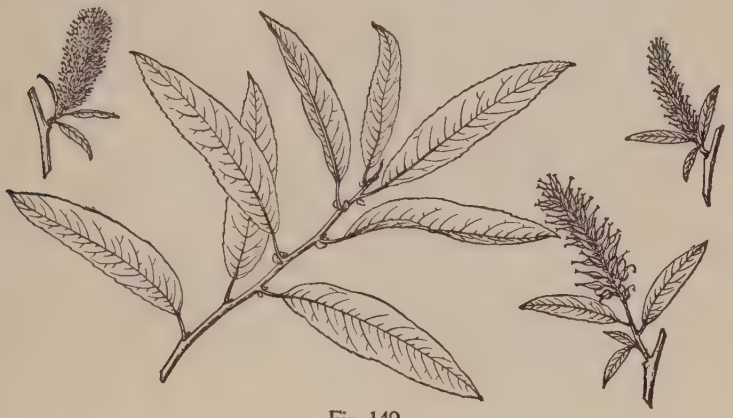

Fig. 149

Idaho, and northwestern Wyoming, and to western Nevada (Lake County; *M. S. Bebb*), and on the high Sierra Nevada in Calaveras and Mariposa Counties, California (*W. L. Jepson*).

16. Salix missouriensis Bebb.

Leaves lanceolate or oblanceolate, acuminate and long-pointed at apex, gradually narrowed from above the middle to the cuneate or rounded base, finely glandular-serrate,

Fig. 150

coated with pale hairs on the lower surface and pilose on the upper surface when they unfold, soon becoming nearly glabrous, at maturity thin and firm, dark green above, pale and often silvery white below, 4′–6′ long, 1′–1½′ wide, with slender veins often united near the margins and connected by coarse reticulate veinlets; petioles stout, pubescent or tomentose, ½′–¾′ long; stipules foliaceous, semicordate, pointed or rarely reniform and obtuse, serrate with incurved teeth, dark green and glabrous on the upper side, coated on the lower with hoary tomentum, reticulate-venulose, often ½′ long, deciduous or persistent during the season. **Flowers:** aments oblong-cylindric, densely flowered, appearing early in February on short leafy branchlets, the staminate 1½′ long and nearly ½′ wide and rather longer than the more slender pistillate aments becoming at maturity lax and 3′–4′ long; scales oblong-obovate, light green, and covered on the outer surface with long straight white hairs; stamens 2, with elongated free glabrous filaments; ovary cylindric, short-stalked, beaked, glabrous, with a short style and spreading entire or slightly emarginate stigmas. **Fruit** narrow, long-pointed light reddish brown, ⅓′ in length; pedicels about half the length of the scales.

A tree, 40°–50° high, with a tall straight trunk 10′–12′ or rarely 18′ in diameter, rather slender upright slightly spreading branches forming a narrow open symmetrical head, and slender branchlets marked by small scattered orange-colored lenticels, light green and coated during their first year with thick pale pubescence, becoming reddish brown and glabrous or puberulous in their second winter. **Winter-buds** ovoid, round, or flattened, acute at the apex, reddish brown, hoary-tomentose, nearly 1′ long. **Bark** thin, smooth, light gray, slightly tinged with red, and covered with minute closely appressed plate-like scales. **Wood** dark red-brown, with thin pale sapwood; durable, used for fence-posts.

Distribution. Deep sandy alluvial bottom-lands of the Missouri River in southwestern Nebraska to western Missouri; through northeastern Kansas and eastern Oklahoma to Cache Creek, Comanche County (*G. W. Stevens*); and from the neighborhood of St. Louis to southeastern and western Iowa; and to the neighborhood of Olney, Richland County, Illinois (*R. Ridgway*).

17. Salix pyrifolia Anders.

Salix balsamifera Barr.

Leaves ovate to oblong-lanceolate, acute at apex, broad and rounded and usually subcordate at base, finely glandular serrulate, balsamic particularly while young, when they unfold thin, pellucid, red and coated below with long slender caducous hairs, at maturity thin and firm, dark green above, pale and glaucous below, 2′–4′ long, 1′–1½′ wide,

Fig. 151

with a yellow midrib and conspicuous reticulate veinlets; petioles reddish or yellow, $\frac{1}{3}'$–$\frac{1}{2}'$ long; stipules often wanting or on vigorous shoots foliaceous, broadly ovate and acute. **Flowers:** aments cylindric, 1′–$1\frac{1}{2}'$ long, on short leafy branchlets, the staminate 1′–$1\frac{1}{4}'$ long and $\frac{5}{4}'$ in diameter and shorter and broader than the pistillate ament; scales obovate, rose-colored, coated with long white hairs; stamens 2, with free filaments and reddish ultimately yellow anthers; ovary narrow-ovoid, long-stalked, gradually contracted above the middle, with a short style and emarginate stigmas. **Fruit** ovoid-conic, $\frac{1}{4}'$ long, dark orange color; pedicels $\frac{1}{6}'$ in length.

Usually a shrub, often making clumps of crowded slender erect stems generally destitute of branches except near the top, rarely arborescent, with a height of 25°, a trunk 12′–14′ in diameter, erect branches, and comparatively stout reddish brown branchlets becoming olive-green in their second year and marked with narrow slightly raised leaf-scars. **Winter-buds** acute, much-compressed, bright scarlet, very lustrous, about $\frac{1}{4}'$ long. **Bark** thin, smooth, dull gray.

Distribution. Cold wet bogs; Newfoundland and the coast of Labrador to the valley of the Saskatchewan and the Mackenzie, and British Columbia, and to northern Maine, New Hampshire, Vermont, New York, Michigan, and northeastern South Dakota; reported to become arborescent only near Fort Kent on the St. John River, Aroostook, Maine.

18. Salix amplifolia Cov.

Leaves oval to broadly obovate, rounded or broadly pointed at apex, gradually or abruptly narrowed at the cuneate base, dentate-serrulate or entire, densely villose when they unfold, with long matted white hairs, at maturity nearly glabrous, pale yellow-green above, slightly glaucous below, 2′–$2\frac{1}{2}'$ long, 1′–$1\frac{1}{2}'$ wide, with a midrib broad and hoary-tomentose toward the base of the leaf and thin and glabrous above the middle; petioles

Fig. 152

slender, tomentose. **Flowers:** aments appearing about the middle of June, stout, pedunculate, tomentose, on leafy branchlets, the staminate $1\frac{1}{2}'$–2′ long and shorter than the pistillate; scales oblanceolate or lanceolate, dark brown or nearly black, covered with long pale hairs; stamens 2, with slender elongated glabrous filaments; ovary ovoid-lanceolate, short-stalked, glabrous or slightly pubescent, gradually narrowed into the elongated slender style crowned with a 2-lobed slender stigma. **Fruit** ovoid-lanceolate, glabrous, short-stalked, $\frac{1}{4}'$ long.

A tree, occasionally 25° high, with a trunk a foot in diameter, and stout branchlets conspicuously roughened by the large elevated U-shaped leaf-scars, and marked by occasional pale lenticels, coated at first with thick villose pubescence, becoming during their second and third years dark dull reddish purple.

Distribution. Sand dunes on the shores of Yakutat Bay and Disenchantment Bay, Alaska.

19. Salix alaxensis Cov. Feltleaf Willow.

Leaves elliptic-lanceolate to obovate, acute, acuminate or occasionally rounded at apex, gradually narrowed into a short thick petiole, coated above as they unfold with thin pale deciduous tomentum and covered below with a thick mass of snowy white lustrous hairs persistent on the mature leaves, entire, often somewhat wrinkled, dull yellow-green above, 2′–4′ long, 1′–1½′ wide, with a broad yellow midrib; stipules linear-lanceolate to filiform, entire, ½′–¾′ long, usually persistent until midsummer. **Flowers:** aments appearing in June when the leaves are nearly fully grown, stout, erect, tomentose, stalked, on leafy branchlets, the staminate 1′–1½′ long, much shorter than the pistillate; scales oblong-ovate, rounded at apex, dark-colored, and coated with long silvery white soft hairs; stamens 2, with slender elongated filaments; ovary acuminate, short-stalked, covered with soft pale hairs, gradually narrowed into the elongated slender style, with 2-lobed stigmas. **Fruit** nearly sessile, ovoid, acuminate covered with close dense pale tomentum, ¼′ long.

A tree, sometimes 30° high, with a trunk 4′–6′ in diameter, and stout branchlets thickly

Fig. 153

coated at first with matted white hairs, becoming in their second year glabrous, dark purple, lustrous, marked by large elevated pale scattered lenticels and much roughened by large U-shaped leaf-scars; often shrubby, and in the most exposed situations frequently only a foot or two high, with semiprostrate stems.

Distribution. Coast of Alaska from the Alexander Archipelago to Cape Lisbourne, and eastward to the valley of the Mackenzie River and to the shores of Coronation Gulf; the only arborescent Willow in the coast region west and north of Kadiak Island; attaining its largest size from the Shumagin Islands eastward.

20. Salix Bebbiana Sarg.

Leaves oblong-obovate to oblong-elliptic or lanceolate, acuminate and short-pointed or acute at apex, gradually narrowed and cuneate or rounded at base, remotely and irregularly serrate usually only above the middle, or rarely entire, when they unfold pale gray-green, glabrous or villose, and often tinged with red on the upper surface and coated on the lower with pale tomentum or pubescence, at maturity thick and firm, dull green and glabrous or puberulous above, blue or silvery white and covered with pale rufous pubescence below, especially along the midrib, veins, and conspicuous reticulate veinlets, 1′–3′ long, ½′–1′ wide; petioles slender, often pubescent, reddish, ¼′–½′ long; stipules foliaceous, semicordate, glandular-dentate, sometimes nearly ½′ long on vigorous shoots, deciduous. **Flowers:**

aments terminal on short leafy branchlets; scales ovate or oblong, rounded at apex, broader on the staminate than on the pistillate plant, yellow below, rose color at apex, villose with long pale silky hairs, persistent under the fruit; staminate aments cylindric, obovoid, narrowed at base, densely flowered, ¾′–1′ long, ½′–1′ thick; pistillate aments oblong-cylindric, loosely flowered, 1′–1½′ long, ½′ thick; stamens 2, with free glabrous filaments; ovary cylindric, villose; with long silky white hairs, gradually narrowed at apex, with broad sessile entire or emarginate spreading yellow stigmas; pedicel villose, about ¼′ in length, and about as long as the scale. **Fruit** elongated-cylindric, gradually narrowed into a long thin beak, and raised on a slender stalk sometimes ½′ long.

A bushy tree, occasionally 25° high, with a short trunk 6′–8′ in diameter, stout ascending branches forming a broad round head, and slender branchlets coated at first with hoary deciduous tomentum, varying during their first winter from reddish purple to dark orange-brown, marked by scattered raised lenticels and roughened by conspicuous elevated leaf-scars, growing lighter-colored and reddish brown in their second year; usually much smaller and often shrubby in habit. **Bark** thin, reddish or olive-green or gray tinged with red, and

Fig. 154

slightly divided by shallow fissures into appressed plate-like scales. **Winter-buds** oblong, gradually narrowed and rounded at apex, full and rounded on the back, bright light chestnut-brown, nearly ¼′ long.

Distribution. Borders of streams, swamps, and lakes, hillsides, open woods and forest margins, usually in moist rich soil; valley of the St. Lawrence River to the shores of Hudson's Bay, the valley of the Mackenzie River within the Arctic Circle, Cook Inlet, Alaska, and the coast ranges of British Columbia, forming in the region west of Hudson's Bay almost impenetrable thickets, with twisted and often inclining stems; common in all the northern states, ranging southward to Pennsylvania and westward to Minnesota and through the Rocky Mountain region from western Idaho and northern Montana to northern North Dakota, eastern South Dakota, northeastern and central Iowa, and western Nebraska, and southward through Colorado to northern Arizona; ascending as a low shrub in Colorado to an altitude of 10,000°.

21. Salix discolor Muehl. Glaucous Willow.

Leaves lanceolate to elliptic, gradually narrowed at the ends, remotely crenulate-serrate, as they unfold thin, light green often tinged with red, pubescent above and coated with a pale tomentum below, at maturity thick and firm, glabrous, conspicuously reticulate-venulose, bright green above, glaucous or silvery white below, 3′–5′ long, ¾′–1½′ wide, with

a broad yellow midrib and slender arcuate primary veins; petioles slender, $\frac{1}{2}'$–$1'$ long; stipules foliaceous, semilunar, acute, glandular-dentate, about $\frac{1}{4}'$ long, deciduous. **Flowers:** aments appearing late in winter or in very early spring, erect, terminal on short scale-bearing branchlets coated with thick white tomentum, oblong-cylindric, about $1'$ long and $\frac{2}{3}'$ thick, the staminate soft and silky before the flowers open and densely flowered; scales oblong-obovate, dark reddish brown toward the apex, covered on the back with long silky silvery white hairs; stamens 2, with elongated glabrous filaments; ovary oblong-cylindric, narrowed above the middle, villose, with a short distinct style and broad spreading entire stigmas; pedicel glabrous, about twice the length of the scale. **Fruit** cylindric, more or less contracted above the middle, long-pointed, light brown, coated with pale pubescence.

A tree, rarely more than 25° high, with a trunk about 1° in diameter, stout ascending

Fig. 155

branches forming an open round-topped head, and stout branchlets marked by occasional orange-colored lenticels, dark reddish purple and coated at first with pale deciduous pubescence; more often shrubby, with numerous tall straggling stems. **Winter-buds** semiterete, flattened and acute at the apex, about $\frac{3}{8}'$ long, dark reddish purple and lustrous. **Bark** $\frac{1}{4}'$ thick, light brown tinged with red, and divided by shallow fissures into thin plate-like oblong scales. **Wood** light, soft, close-grained, brown streaked with red, with lighter brown sapwood.

Distribution. Moist meadows and the banks of streams and lakes; Nova Scotia to Manitoba, and southward to Delaware, southern Indiana and Illinois, eastern and southwestern Iowa, the Black Hills of South Dakota, and northeastern Missouri; common.

A form of *Salix discolor* with more densely flowered and more silvery pubescent aments is described as var. *eriocephala* Schn. and a form with loosely flowered aments with less tomentose fruits with longer styles and with narrower leaves as var. *prinoides* Schn.

22. Salix Scouleriana Barr. Black Willow.

Salix Nuttallii Sarg.

Leaves oblong-obovate to elliptic, acute or abruptly acuminate with a short or long-pointed apex, gradually narrowed and cuneate at the often unsymmetrical base, entire or remotely and irregularly crenately serrate, thin and firm, dark yellow-green and lustrous above, pale or glaucous and glabrous or pilose below, $1\frac{1}{4}'$–$4'$ long, $\frac{1}{2}'$–$1\frac{1}{2}'$ wide, with a broad yellow pubescent midrib and slender veins forked and arcuate within the slightly thickened and revolute margins and connected by conspicuous reticulate veinlets; petioles slender,

puberulous, $\frac{1}{4}'$–$\frac{1}{2}'$ in length; stipules foliaceous, semilunar, glandular-serrate, $\frac{1}{8}'$–$\frac{1}{4}'$ long, caducous. **Flowers**: aments appearing before the leaves, oblong-cylindric, erect, nearly sessile on short tomentose scale-bearing branchlets, the staminate about 1′ long and rather more than $\frac{1}{2}'$ thick, the pistillate $1\frac{1}{2}'$ long, about $\frac{5}{12}'$ thick; scales oblong, narrowed at the ends, dark-colored, covered with long white hairs, persistent under the fruit; stamens 2, with free glabrous filaments; ovary cylindric, short-stalked, with a distinct style and broad emarginate stigmas: pedicels less than half the length of the scale, villose. **Fruit** oblong-ovoid, acuminate, light reddish brown, pale pubescent, about $\frac{1}{3}'$ long.

A tree, occasionally 30° high, with a short trunk rarely exceeding 1° in diameter, slender pendulous branches forming a rather compact round-topped shapely head, and stout branchlets marked by scattered yellow lenticels, coated when they first appear with pale early deciduous pubescence, becoming bright yellow or dark orange color, and in their second year dark red-brown and much roughened by the conspicuous leaf-scars; or more often a shrub. **Winter-buds** ovoid, acute, nearly terete or slightly flattened, with narrow lateral wing-like margins, light or dark orange color, glabrous or pilose at the base, about

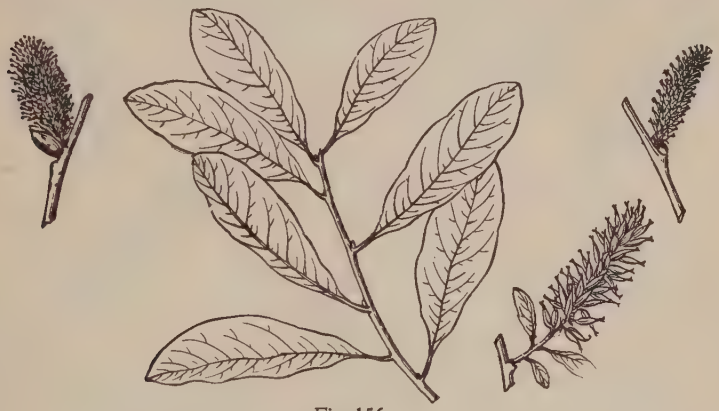

Fig. 156

$\frac{1}{4}'$ long. **Bark** thin, dark brown slightly tinged with red, and divided into broad flat ridges. **Wood** light, soft, close-grained, light brown tinged with red, with thick nearly white sapwood.

Distribution. Cook's Inlet, coast of Alaska, and valley of the Yukon River near Dawson southward through western British Columbia to northern California, ranging eastward through Washington and northwestern Oregon to northern Idaho and Montana.

From central California to San Bernardino County represented by the variety *crassijulis* Andr. (S. *brachystachys* Benth.) with shorter and broader obovate leaves rounded at apex, pubescent and tomentose branchlets and larger pubescent winter-buds. A tree sometimes 70° high with a trunk often $2\frac{1}{2}$° in diameter.

On the high Sierra Nevada eastward to the eastern ranges of the Rocky Mountains of Colorado and to northern New Mexico, northern Wyoming and the Black Hills of South Dakota represented by the var. *flavescens* Schn. A shrub or rarely a small tree with obovate rounded yellowish leaves and branchlets.

43. Salix Hookeriana Barr.

Leaves oblong to oblong-obovate, acute or abruptly acuminate, or rarely rounded and frequently apiculate at apex, gradually narrowed and cuneate or rounded at base, coarsely crenately serrate, especially those on vigorous shoots, or entire, when they unfold vil-

lose with pale hairs, or tomentose above and clothed below with silvery white tomentum, at maturity thin and firm, bright yellow-green and lustrous, nearly glabrous or tomentose on the upper surface, pale and glaucous and tomentose or pubescent on the lower surface, especially along the midrib and slender arcuate primary veins and conspicuous reticulate veinlets, 2′–6′ long, 1′–1½′ wide; petioles stout, tomentose, ¼′–⅓′ long. **Flowers:** aments oblong-cylindric, erect, rather lax, often more or less curved, about 1½′ long, on short tomentose scale-bearing branchlets, the staminate ⅔′ thick and rather thicker than the pistillate; scales oblong-obovate, yellow, coated with long pale hairs, the staminate rounded above and rather shorter than the more acute scales of the pistillate ament persistent under the fruit; stamens 2, with free elongated glabrous filaments; ovary conic, glabrous, stalked, with a slender stalk about one third as long as the scale, gradually narrowed above, with a slender elongated bright red style and broad spreading entire stigmas. **Fruit** oblong-cylindric, narrowed above, about ¼′ long.

Fig. 157

A tree, occasionally 30° high, with a trunk about 1° in diameter, and stout branchlets marked by large scattered orange-colored lenticels, covered during their first season with hoary tomentum and rather bright or dark red-brown and pubescent in their second summer; more often shrubby, with numerous stems 4′–8′ thick and 15°–20° high; frequently a low bush, with straggling almost prostrate stems. **Winter-buds** ovoid, acute, nearly terete, dark red, coated with pale pubescence, about ¼′ long. **Bark** nearly ⅛′ thick, light red-brown, slightly fissured and divided into closely appressed plate-like scales. **Wood** light, soft, close-grained, light brown tinged with red, with thin nearly white sapwood.

Distribution. Borders of salt marshes and ponds and sandy coast dunes; Vancouver Island southward along the shores of Puget Sound and the Pacific Ocean to southern Oregon.

24. Salix sitchensis Sanson.

Leaves oblong-obovate to oblanceolate, entire or minutely glandular dentate, acute or acuminate, or rounded and short-pointed, or rounded at apex, gradually narrowed and cuneate at base, when they unfold pubescent or tomentose on the upper surface, and coated on the lower with lustrous white silky pubescence or tomentum persistent during the season or sometimes deciduous from the leaves of vigorous young shoots, at maturity thin and firm, dark green, lustrous and glabrous above, with the exception of the pubescent midrib, 2′–5′ long, ¾′–1½′ wide, with conspicuous slender veins arcuate and united within the margins and prominent reticulate veinlets; petioles stout, pubescent, rarely ½′ long; stipules rarely produced, foliaceous, semilunar, acute or rounded at apex, glandular-dentate, coated below with hoary tomentum, often ½′ long, caducous. **Flowers:** aments

cylindric, densely flowered, erect on short tomentose leafy branchlets, the staminate $1\frac{1}{2}'$–$2'$ long and $\frac{1}{2}'$ thick, the pistillate $2\frac{1}{2}'$–$3'$ long, and $\frac{1}{4}'$ thick; scales yellow or tawny, the staminate oblong-obovate, rounded at the apex, covered with long white hairs, much longer than the more acute pubescent scales of the pistillate ament; stamen 1, with an elongated glabrous filament, or very rarely 2, with filaments united below the middle or nearly to the apex; ovary short-stalked, ovoid, conic, acute, pubescent and gradually narrowed into the elongated style, with entire or slightly emarginate short stigmas. **Fruit** ovoid, narrowed above, light red-brown, pubescent about $\frac{1}{4}'$ long.

Fig. 158

A much-branched tree, occasionally 25°–30° high, with a short contorted often inclining trunk sometimes 1° in diameter, and slender brittle branchlets coated at first with hoary tomentum, pubescent and tomentose and dark red-brown or orange color during their first winter, becoming darker, pubescent or glabrous, and sometimes covered with a glaucous bloom in their second season; more often shrubby and 6°–15° tall. **Winter-buds** acute, nearly terete, light red-brown, pubescent or puberulous, about $\frac{1}{4}'$ long. **Bark** about $\frac{1}{8}'$ thick and broken into irregular closely appressed dark brown scales tinged with red. **Wood** light, soft, close-grained, pale red, with thick nearly white sapwood.

Distribution. Banks of streams and in low moist ground; Cook Inlet and Kadiak Island, Alaska, southward in the neighborhood of the coast to Santa Barbara, California; on the Marble Creek of the Kaweah River at 6900° altitude (f. *Ralphiana* Jeps.)

VI. MYRICACEÆ.

Aromatic resinous trees and shrubs, with watery juice, terete branches, and small scaly buds. **Leaves** alternate, revolute in the bud, serrate, resinous-punctate, persistent in our species, in falling leaving elevated semiorbicular leaf-scars showing the ends of three nearly equidistant fibro-vascular bundles. **Flowers** unisexual, dicœcious or monœcious, usually subtended by minute bractlets, in the axils of the deciduous scales of unisexual or androgynous simple oblong aments from buds in the axils of the leaves of the year, opening in early spring, the staminate below the pistillate in androgynous aments; staminate, perianth 0; stamens 4 or many, inserted on the thickened base of the scales of the ament; filaments slender, united at the base into a short stipe; anthers ovoid, erect, 2-celled, introrse, opening longitudinally; ovary rudimentary or 0; pistillate flowers single or in pairs; ovary sessile, 1-celled; styles short, divided into 2 elongated filiform stigmas stigmatic on the inner face; ovule solitary, erect from the base of the cell, orthotropous, the micropyle superior. **Fruit** a globose or ovoid dry drupe usually covered with wax; nut hard, thick-walled. Seed

erect, with a thin coat, without albumen; embryo straight; cotyledons plano-convex, fleshy; radicle short, superior, turned away from the minute basal hilum.

The family consists of the genus *Myrica* L., of about thirty or forty species of small trees and shrubs, widely distributed through the temperate and warmer parts of both hemispheres. Of the seven North American species three are trees. Wax is obtained from the exudations of the fruit of several species. The bark is astringent, and sometimes used in medicine, in tanning, and as an aniline dye. *Myrica rubra* Sieb and Zucc., of southern Japan and China, is cultivated for its succulent aromatic red fruit.

The generic name is probably from the ancient name of some shrub, possibly the Tamarisk.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Flowers dicœcious.

Leaves oblanceolate, usually acute or rarely rounded at apex, mostly coarsely serrate above the middle, yellow-green, coated below with conspicuous orange-colored glands. **1. M. cerifera** (A, C).

Leaves usually broadly oblong-obovate, rounded or rarely acute at apex, entire, dark green and lustrous. **2. M. inodora** (C).

Flowers monœcious; leaves oblanceolate or oblong-lanceolate, sharply serrate, dark green and lustrous. **3. M. californica** (G).

1. Myrica cerifera L. Wax Myrtle.

Leaves oblanceolate or rarely oblong-lanceolate, acute or rarely gradually narrowed and rounded at apex, cuneate at base, decurrent on short stout petioles, coarsely serrate above the middle or entire, yellow-green, covered above by minute dark glands and below

Fig. 159

by bright orange-colored glands, $1\frac{1}{2}'$–$4'$ long and $\frac{1}{4}'$–$\frac{1}{2}'$ wide, with a slender pale midrib often puberulous below, and few obscure arcuate veins, fragrant with a balsamic resinous odor; gradually deciduous at the end of their first year. **Flowers** in small oblong aments, with ovate acute ciliate scales, those of the staminate plant $\frac{1}{2}'$–$\frac{3}{4}'$ long, about twice as long as those of the pistillate plant; stamens few, with oblong slightly obcordate anthers at first tinged with red, becoming yellow; ovary gradually narrowed into 2 slender spreading stigmas longer than its scale. **Fruit** in short spikes, ripening in September and October and persistent on the branches during the winter, irregularly deciduous in the spring and early summer, globose, about $\frac{1}{8}'$ in diameter, slightly papillose, light green, coated with thick pale blue wax; **seed** pale, minute.

A tree, occasionally 40° high, with a tall trunk 8′–10′ in diameter, or more often a large or small shrub, with slender upright or slightly spreading branches forming a narrow round-topped head, and slender branchlets marked by small pale lenticels, coated at first with loose rufous tomentum and caducous orange-colored glands, bright red-brown or dark brown tinged with gray, usually lustrous and nearly glabrous during their first winter, finally becoming dark brown; generally smaller, frequently shrubby. **Winter-buds** oblong, acute, $\frac{1}{16}'$–$\frac{1}{8}'$ long, with numerous ovate acute imbricated scales, the inner scales becoming nearly $\frac{1}{2}'$ long, and often persistent until the young branch has completed its growth. **Bark** of the trunk $\frac{1}{4}'$ thick, compact, smooth, light gray. **Wood** light, soft and brittle, dark brown, with thin lighter-colored sapwood.

Distribution. In the neighborhood of the coast; Cape May, New Jersey, southern Delaware and Maryland to the keys of southern Florida, and through the Gulf states to the shores of Aranzas Pass, San Patricio County, Texas, ranging inland over the coastal plain of Georgia to the neighborhood of Natchez, Adams County, Mississippi, the valley of the Red River (Natchitoches, Louisiana and Fulton, Arkansas), and to Cherokee County, Texas, and northward to the valley of the Ouachita River, Arkansas; on the Bermuda and Bahama Islands and on several of the Antilles; most abundant and of its largest size on the south Atlantic and Gulf coasts in sandy swamps and pond holes; the most common woody plant and forming great thickets on the Everglades east of Lake Okeechobee, Florida; in the sandy soil of Pine-barrens and on dry arid hills of the interior, often only a few inches in height, var. *pumila* Michx.

2. Myrica inodora W. Bartr. Wax Myrtle.

Leaves broadly oblong-obovate or rarely ovate, rounded or sometimes pointed and occasionally apiculate at apex, narrowed at base, decurrent on short stout petioles, entire or

Fig. 160

rarely obscurely toothed toward the apex, thick and coriaceous, glandular-punctate, dark green and very lustrous above, bright green below, 2′–4′ long, $\frac{3}{4}'$–$1\frac{1}{2}'$ wide, with a broad conspicuously glandular midrib slightly pubescent on the lower side, and few remote slender obscure primary veins forked and arcuate near the much-thickened and revolute margins; gradually deciduous from May until midsummer. **Flowers** in aments $\frac{3}{4}'$–1′ long, with ovate acute glandular scales; stamens numerous, with oblong slightly emarginate yellow anthers; pistillate flowers usually in pairs, with an ovate glabrous ovary and slender bright red styles. **Fruit** produced sparingly in elongated spikes, oblong, $\frac{1}{3}'$–$\frac{1}{2}'$ long, papillose, black, and covered with a thin coat of white wax: **seed** oblong-oval, acute at apex, rounded at base, $\frac{1}{8}'$ long, bright orange-brown, with a pale yellow hilum.

Usually a shrub, with numerous slender stems, occasionally arborescent and 18°–20°

high, with a straight trunk 6°–8° tall and 2′–3′ in diameter, and stout branchlets roughened by small scattered lenticels, coated at first with dense pale tomentum, soon becoming bright red-brown, scurfy, and glabrous or pubescent. **Winter-buds** ovoid, acute, nearly $\frac{1}{8}$′ long, with numerous loosely imbricated lanceolate acute red-brown scurfy-pubescent scales. **Bark** thin, smooth, nearly white.

Distribution. Small non-alluvial swamps mostly within fifty miles of the coast, Round Lake, Jackson County, and Apalachicola, and Saint Andrews Bay, Florida; near Mobile and Stockton, Alabama; near Poplarville, Pearl County, Mississippi, and Bogalusa, Washington Parish, Louisiana.

3. Myrica californica Cham. Wax Myrtle.

Leaves oblanceolate to oblong-lanceolate, acute at apex, remotely serrate except at the gradually narrowed base with small incurved teeth, decurrent on a short stout petiole, thin and firm, dark green and lustrous above, yellow-green, glabrous or puberulous and

Fig. 161

marked by minute black glandular dots below, 2′–4′ long, $\frac{1}{2}$′–$\frac{3}{4}$′ wide, with a narrow yellow midrib and numerous obscure primary veins arcuate near the thickened and revolute margins, slightly fragrant, gradually deciduous after the end of their first year. **Flowers** subtended by conspicuous bractlets, those of the two sexes on the same plant; staminate in oblong simple aments often 1′ long, pistillate in shorter aments in the axils of upper leaves, androgynous aments occurring between the two with staminate flowers at their base and pistillate flowers above, or with staminate flowers also mixed with the pistillate at their apex; scales of the aments ovate, acute, coated with pale tomentum; stamens numerous, with oblong slightly emarginate dark red-purple anthers soon becoming yellow; ovary ovoid, with bright red exserted styles. **Fruit** in short crowded spikes ripening in the early autumn and usually falling during the winter, globose, papillose, dark purple, covered with a thin coat of grayish white wax; **seed** pale reddish brown, minute.

A tree, occasionally 40° high, with a trunk 14′–15′ in diameter, short slender branches forming a narrow compact round-topped head, and stout branchlets coated at first with loose tomentum, dark green or light or dark red-brown, glabrous or pubescent during their first season, becoming in their second year much roughened by the elevated leaf-scars, darker and ultimately ashy gray; usually smaller at the north and toward the northern and southern limits of its range reduced to a low shrub often only 3°–4° tall. **Winter-buds** ovoid, acute, about $\frac{1}{3}$′ thick, with loosely imbricated ovate acute dark red-brown tomentose scales nearly $\frac{1}{2}$′ long when fully grown and long-persistent on the branch. **Bark** smooth, compact, $\frac{1}{16}$′–$\frac{1}{8}$′ thick, dark gray or light brown on the surface and dark red-brown internally. **Wood** heavy, very hard and strong, brittle, close-grained, light rose color, with thick lighter colored sapwood.

Distribution. Ocean sand-dunes and moist hillsides in the vicinity of the coast from the shores of Puget Sound to the neighborhood of Santa Monica, Los Angeles County, California; of its largest size on the shores of the Bay of San Francisco.

Occasionally used in California as a garden plant.

VII. LEITNERIACEÆ.

A tree or shrub, with pale slightly fissured bark, scaly buds, stout terete pithy branchlets marked by pale conspicuous nearly circular lenticels and by elevated crescent-shaped angled or obscurely 3-lobed leaf-scars, very light soft wood, and thick fleshy stoloniferous yellow roots. **Leaves** involute in the bud, lanceolate to elliptic-lanceolate, acuminate or acute and short-pointed at apex, gradually narrowed at base, entire, with slightly revolute undulate margins, penniveined with remote primary veins arcuate and united near the margins, and conspicuous reticulate veinlets, petiolate, at first coated on the lower surface and on the petioles with thick pale tomentum and puberulous on the upper surface, thick and firm at maturity, bright green and lustrous above, pale and villose-pubescent below, deciduous. Flowers in unisexual aments, with ovate acute concave tomentose scales, the male and female on different plants, opening in early spring from buds formed the previous autumn and covered with acute chestnut-brown hairy scales; the staminate clustered near the end of the branches, their scales bearing on the thickened stipe a ring of 3–12 stamens, with slender incurved filaments and oblong light yellow introrse 2-celled anthers opening longitudinally; perianth 0; pistillate aments scattered, shorter and more slender than the staminate, their scales bearing in their axils a short-stalked pistil surrounded by a rudimentary perianth of small gland-fringed scales, the 2 larger lateral, the others next the axis of the inflorescence; ovary superior, pubescent, 1-celled, with an elongated flattened style inserted obliquely, curving inward above the middle in anthesis, grooved and stigmatic on the inner face; ovule solitary, attached laterally, ascending, semianatropous; micropyle directed upward. Fruit an oblong compressed dry drupe thick and rounded on the ventral, narrowed on the dorsal edge, rounded at base, thin and pointed at apex, chestnut-brown, rugose, with a thick dry exocarp closely investing the thin-walled light brown crustaceous rugose nutlet. Seed flattened, rounded at the ends, light brown, marked on the thick edge with the oblong nearly black hilum; embryo erect, surrounded by thin fleshy albumen; cotyledons oblong, flattened; radicle superior, conical, short, and fleshy.

The family consists of a single genus, *Leitneria* Chapm., with one species of the southern United States, named for a German naturalist killed in Florida during the Seminole War.

1. Leitneria floridana Chapm. Cork Wood.

Leaves 4′–6′ long, 1½′–2½′ wide, with petioles 1′–2′ in length. **Flowers** opening at the end of February or early in March; staminate aments 1′–1¼′ long, ¼′ thick, and twice as long as the pistillate. **Fruit** solitary or in clusters of 2–4, ripening when the leaves are about half grown, ¾′ long, ½′ wide.

A shrub or small tree, occasionally 20° high, with a slender straight trunk 4′–5′ in diameter above the swollen gradually tapering base, spreading branches forming a loose open head, and branchlets at first light reddish brown and thickly coated with gradually deciduous hairs, becoming in their first winter glabrous or puberulous, especially toward the ends, and dark red-brown. **Winter-buds**: terminal broad, conic, ⅛′ long, covered by 10 or 12 oblong nearly triangular closely imbricated scales coated with pale tomentum and long-persistent at the base of the branch; lateral scattered, ovoid, flattened. **Bark** about 1/16′ thick, dark gray faintly tinged with brown, divided by shallow fissures into narrow rounded ridges. **Wood** soft, exceedingly light, close-grained, the layers of annual growth hardly distinguishable, pale yellow, without trace of heartwood; occasionally used for the floats of fishing-nets.

Distribution. Borders of swamps of the lower Altamaha River, Georgia (*C. L. Boynton*);

muddy saline shores on the coast of the Gulf of Mexico near Apalachicola, Florida; swampy prairies, Velasco (*E. J. Palmer*), and swamps of the Brazos River near Columbia, Brazoria County, Texas; Varner, Lincoln County (*B. F. Bush*), and Moark, Clay County

Fig. 162

(*E. J. Palmer*) Arkansas; and in Butler and Dunklin Counties, southeastern Missouri, here sometimes occupying muddy sloughs of considerable extent to the exclusion of other woody plants.

VIII. JUGLANDACEÆ.

Aromatic trees, with watery juice, terete branchlets, scaly buds, the lateral buds often superposed, 2–4 together, and alternate unequally pinnate deciduous leaves with elongated grooved petioles and without stipules, the leaflets increasing in size from the lowest upward, penniveined, sessile, short-stalked or the terminal usually long-stalked. Flowers monœcious, opening after the unfolding of the leaves, the staminate in lateral aments and composed of a 3–6-lobed calyx in the axil of and adnate to an ovate acute bract, and numerous stamens inserted on the inner and lower face of the calyx in 2 or several rows, with short distinct filaments and oblong anthers opening longitudinally; the pistillate in a spike terminal on a branch of the year and composed of a 1–3-celled ovary subtended by an involucre free toward the apex and formed by the union of an anterior bract and 2 lateral bractlets, a 1 or 4-lobed calyx inserted on the ovary, a short style with 2 plumose stigmas stigmatic on the inner face, and a solitary erect orthotropous ovule. Fruit drupaceous, the exocarp (husk) indehiscent or 4-valved, inclosing a thick- or thin-shelled nut divided by partitions extending inward from the shell, and like the shell more or less penetrated by internal longitudinal cavities often filled with dry powder. Seed solitary, 2-lobed from the apex nearly to the middle, light brown, its coat thin, of 2 layers, without albumen; cotyledons fleshy and oily, sinuose or corrugated, 2-lobed; radicle short, superior, filling the apex of the nut. Of the six genera of the Walnut family two occur in North America.

CONSPECTUS OF THE NORTH AMERICAN GENERA.

Aments of staminate flowers simple; husk of the fruit indehiscent; nut sculptured; pith in plates. **1. Juglans.**

Aments of staminate flowers branched; husk of the fruit 4-valved; nut not sculptured; pith solid. **2. Carya**

1. JUGLANS L. Walnut.

Trees, with furrowed scaly bark, durable dark-colored wood, stout branchlets, laminate pith, terminal buds with 2 pairs of opposite more or less open scales often obscurely pinnate at apex, those of the inner pair more or less leaf-like, and obtuse slightly flattened axillary buds formed before midsummer and covered with 4 ovate rounded scales, closed or open during winter. Leaves with numerous leaflets, and terete petioles leaving in falling large conspicuous elevated obcordate 3-lobed leaf-scars displaying 3 equidistant U-shaped clusters of dark fibro-vascular bundle-scars; leaflets conduplicate in the bud, ovate, acute or acuminate, mostly unequal at base, with veins arcuate and united near the margins. Aments of the staminate flowers many-flowered, elongated, solitary or in pairs from lower axillary buds of upper nodes, appearing from between persistent bud-scales in the autumn and remaining during the winter as short cones covered by the closely imbricated bracts of the flowers; calyx 3–6-lobed, its bract free only at the apex; stamens 8–40, in 2 or several ranks, their anthers surmounted by a conspicuous dilated truncate or lobed connective; pistillate flowers in few-flowered spikes, their involucre villose, free only at the apex and variously cut into a laciniate border shorter than the erect calyx-lobes; ovary rarely of 3 carpels; stigmas club-shaped, elongated, fimbriately plumose. Fruit ovoid, globose or pyriform, round or obscurely 4-angled, with a fleshy indehiscent glabrate or hirsute husk; nut ovoid or globose, more or less flattened, hard, thick-walled, longitudinally and irregularly rugose, the valves alternate with the cotyledons, and more or less ribbed along the dorsal sutures and in some species also on the marginal sutures. Seed more or less compressed, gradually narrowed or broad and deeply lobed at base, with conspicuous dark veins radiating from the apex and from the minute basal hilum.

Juglans is confined to temperate North America, the West Indies, South America from Venezuela to Peru, western and northern China, Korea, Manchuria, Japan, and Formosa. Eleven species are known. Of exotic species *Juglans regia* L., an inhabitant probably originally of China, is cultivated in the middle Atlantic and southern states and largely in California for its edible nuts, which are an important article of commerce. The wood of several species is valued for the interior finish of houses and for furniture.

Juglans, from Jupiter and glands, is the classical name of the Walnut-tree.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Fruit racemose; nut 4-ribbed at the sutures with smaller intermediate ribs, 2-celled at the base; heartwood light brown; leaflets 11–17, oblong-lanceolate. 1. **J. cinerea** (A, C).

Fruit usually solitary or in pairs; nut without sutural ribs, 4-celled at the base; heartwood dark brown.

Nuts prominently and irregularly ridged with often interrupted ridges; leaflets 15–23, ovate-lanceolate. 2. **J. nigra** (A, C)

Nuts more or less deeply longitudinally grooved.

Nuts up to $1\frac{1}{2}'$ in diameter; leaflets 9–13, rarely 19, oblong-lanceolate to ovate, acuminate, coarsely serrate. 3. **J. major** (F, H).

Nuts not more than $\frac{3}{4}'$ in diameter.

Leaflets 17–23, narrow-lanceolate, long-pointed. 4. **J. rupestris** (C).

Leaflets 11–15 or rarely 19, oblong-lanceolate, acute or acuminate, the lower often rounded at the apex. 5. **J. californica** (G).

Nuts obscurely or not at all grooved, up to 2′ in diameter; leaflets 15–19, ovate-lanceolate to lanceolate, long-pointed. 6. **J. Hindsii** (G).

1. Juglans cinerea L. Butternut.

Leaves 15′–30′ long, with stout pubescent petioles, and 11–17 oblong-lanceolate acute or acuminate leaflets 2′–3′ long, $1\frac{1}{2}'$–2′ wide, finely serrate except at the unequal rounded

base, glandular and sticky as they unfold, at maturity thin, yellow-green and rugose above, pale and soft-pubescent below; turning yellow or brown and falling early in the autumn. **Flowers**: staminate in thick aments 3′–5′ long; calyx usually 6-lobed, light yellow-green, puberulous on the outer surface, $\frac{1}{4}'$ long, its bract rusty-pubescent, acute at apex; stamens 8–12, with nearly sessile dark brown anthers and slightly lobed connectives; pistillate in 6–8-flowered spikes, constricted above the middle, about $\frac{1}{3}'$ long, its bract and bractlets coated with sticky white or pink glandular hairs and rather shorter than the linear-lanceolate calyx-lobes; stigmas bright red, $\frac{1}{2}'$ long. **Fruit** in 3-5 fruited drooping clusters, obscurely 2 or rarely 4-ridged, ovoid-oblong, coated with rusty clammy matted hairs, $1\frac{1}{2}'$–$2\frac{1}{2}'$ long with a thick husk; **nut** ovoid, abruptly contracted and acuminate at apex, with 4 prominent and 4 narrow less conspicuous ribs, light brown, deeply sculptured between the ribs into thin broad irregular longitudinal plates, 2-celled at the base and 1-celled above the middle; **seed** sweet, very oily, soon becoming rancid.

A tree, occasionally 100° high, with a tall straight trunk 2°–3° in diameter, and sometimes free of branches for half its height; more frequently divided 20° or 30° above the ground into many stout limbs spreading horizontally and forming a broad low symmetrical

Fig. 163

round-topped head, and dark orange-brown or bright green rather lustrous branchlets coated at first with rufous pubescence, covered more or less thickly with pale lenticels, gradually becoming puberulous, brown tinged with red or orange in their second year and marked by light gray leaf-scars with large black fibro-vascular bundle-scars and elevated bands of pale tomentum separating them from the lowest axillary bud. **Winter-buds**: terminal $\frac{1}{2}'$–$\frac{3}{4}'$ long, $\frac{1}{4}'$ wide, flattened and obliquely truncate at apex, their outer scales coated with short pale pubescence; axillary buds ovoid, flattened, rounded at apex, $\frac{1}{8}'$ long, covered with rusty brown or pale pubescence. **Bark** of young stems and of the branches smooth and light gray, becoming on old trees $\frac{3}{4}'$–1′ thick, light brown, deeply divided into broad ridges separating on the surface into small appressed plate-like scales. **Wood** light, soft, not strong, coarse-grained, light brown, turning darker with exposure, with thin light-colored sapwood composed of 5 or 6 layers of annual growth; largely employed in the interior finish of houses, and for furniture. The inner bark possesses mild cathartic properties. Sugar is made from the sap, and the green husks of the fruit are used to dye cloth yellow or orange color.

Distribution. Rich moist soil near the banks of streams and on low rocky hills, southern New Brunswick to the valley of the St. Lawrence River in Ontario, the northern peninsular of Michigan, southern Minnesota, eastern South Dakota, eastern Iowa, southeastern Nebraska, and southward to central Kansas, northern Arkansas, Delaware, eastern

Virginia, and on the Appalachian Mountains and their foothills to northern Georgia; in northern Alabama, southern Illinois and western Tennessee; most abundant northward.

Occasionally cultivated.

× *Juglans quadrangulata* A. Rehd., a natural hybrid of *J. cinerea* and the so-called English Walnut (*J. regia*) is not uncommon in eastern Massachusetts, and a hybrid of *J. cinerea* with the Japanese *J. Sieboldiana* Maxm. has appeared in the United States.

2. Juglans nigra L. Black Walnut.

Leaves 1°–2° long, with pubescent petioles, and 15–23 ovate-lanceolate leaflets 3′–3½′ long, 1′–1¼′ wide, long-pointed, sharply serrate except at the more or less rounded often unequal base, thin, bright yellow-green, lustrous and glabrous above, soft-pubescent below, especially along the slender midrib and primary veins; turning bright clear yellow in the autumn before falling. **Flowers:** staminate in stout puberulous aments 3′–5′ long, calyx rotund, 6-lobed, with nearly orbicular lobes concave and pubescent on the outer surface, its bract ¼′ long, nearly triangular, coated with rusty brown or pale tomentum; stamens 20–30, arranged in many series, with nearly sessile purple and truncate connectives; pistillate in 2–5 flowered spikes, ovoid, gradually narrowed at the apex, ¼′ long, their bract and bractlets coated below with pale glandular hairs and green and

Fig. 164

puberulous above, sometimes irregularly cut into a laciniate border, or reduced to an obscure ring just below the apex of the ovary; calyx-lobes ovate, acute, light green, puberulous on the outer, glabrous or pilose on the inner surface; stigmas yellow-green tinged on the margins with red, ½′–¾′ long. **Fruit** solitary or in pairs, globose, oblong and pointed at apex, or slightly pyriform, light yellow-green, roughened by clusters of short pale articulate hairs, 1½′–2′ in diameter, with a thick husk; **nut** oval or oblong, slightly flattened, 1⅛′–1½′ in diameter, dark brown tinged with red, deeply divided on the outer surface into thin or thick often interrupted irregular ridges, 4-celled at base and slightly 2-celled at the apex; **seed** sweet, soon becoming rancid.

A tree, frequently 100° and occasionally 150° high, with a straight trunk often clear of branches for 50°–60° and 4°–6° in diameter, thick limbs spreading gradually and forming a comparatively narrow shapely round-topped head of mostly upright rigid branches, and stout branchlets covered at first with pale or rusty matted hairs, dull orange-brown and pilose or puberulous during their first winter, marked by raised conspicuous orange-colored lenticels and elevated pale leaf-scars, gradually growing darker and ultimately light brown. **Winter-buds:** terminal ovoid, slightly flattened, obliquely rounded at apex, coated with pale silky tomentum, ⅓′ long, with usually 4 obscurely pinnate scales; axillary

$\frac{1}{8}'$ long, tomentose, their outer scales opening at the apex during the winter. **Bark** of young stems and branches light brown and covered with thin scales, becoming on old trees 2′–3′ thick, dark brown slightly tinged with red, and deeply divided into broad rounded ridges broken on the surface into thick appressed scales. **Wood** heavy, hard, strong, rather coarse-grained, very durable, rich dark brown, with thin lighter colored sapwood of 10–20 layers of annual growth; largely used in cabinet-making, the interior finish of houses, gun-stocks, air-planes, and in boat and shipbuilding.

Distribution. Rich bottom-lands and fertile hillsides, western Massachusetts to southern Ontario, southern Michigan, southeastern Minnesota, central and northern Nebraska, central Kansas, eastern Oklahoma, and southward to western Florida, central Alabama and Mississippi, Louisiana, and the valley of the San Antonio River, Texas; most abundant in the region west of the Alleghany Mountains, and of its largest size on the western slopes of the high mountains of North Carolina and Tennessee, and on the fertile river bottom-lands of southern Illinois and Indiana, southwestern Arkansas, and Oklahoma; largely destroyed for its valuable timber, and now rare.

Occasionally cultivated as an ornamental tree in the eastern United States, and in western and central Europe. × *Juglans intermedia* Carr., a natural hybrid, of *J. nigra* with the so-called English Walnut (*J. regia*) has appeared in the United States and Europe, and on the banks of the James River in Virginia has grown to a larger size than any other recorded Walnut-tree. In California a hybrid, known as "Royal," between *J. nigra* and *J. Hindsii* has been artificially produced.

3. Juglans major Hell. Nogal.

Juglans rupestris var. *major* Torr.

Juglans rupestris Sarg., in part, not Engelm.

Leaves 8′–12′ long, with slender pubescent petioles and rachis, and 9–13 rarely 19 oblong-lanceolate to ovate acuminate often slightly falcate coarsely serrate leaflets cuneate or rounded at base, coated when they first appear with scurfy pubescence, soon becoming

Fig. 165

glabrous, or at maturity slightly pubescent on the midrib below, 3′–4′, or those of the lower pairs $1\frac{1}{2}'$–2′ long, and 1′–$1\frac{1}{2}'$ wide, thin, yellow-green, with a thin conspicuous yellow midrib and primary veins. **Flowers:** staminate in slender puberulous or pubescent aments 8′–10′

long; calyx nearly orbicular, long-stalked, pale yellow-green, 5 or 6-lobed, the lobes ovate, acute, hoary pubescent on the outer surface, their bract acute, coated with thick pale tomentum; stamens 30–40, with nearly sessile yellow anthers, and slightly divided connectives; pistillate not seen. **Fruit** subglobose to slightly ovoid or oblong, abruptly contracted at apex into a short point (*J. elæopyren Dode*), densely tomentose when half grown, 1′–1½′ in diameter, with a thin husk covered with close rufous pubescence; **nut** dark brown or black, slightly compressed, usually rather broader than high, or ovoid, rounded or bluntly acute at apex, rounded and sometimes depressed at base, longitudinally grooved with broad deep grooves, thick shelled; **seed** small and sweet.

A tree sometimes 50° high, with a straight trunk occasionally 3°–4° in diameter, or divided at the ground into several large stems, stout branches forming a narrow head, and slender branchlets thickly coated when they first appear with rufous pubescence, becoming red-brown, pubescent or puberulous and marked by many small pale lenticels at the end of their first season and ashy gray the following year.

Distribution. Near Fort Worth, Tarrant Country, Texas (*E. J. Palmer*); and banks of streams in the cañons of central and southern New Mexico and Arizona, and on Oak Creek near Flagstaff, Arizona on the Colorado plateau (*P. Lowell*).

4. Juglans rupestris Engelm. Walnut.

Leaves 9′–12′ long, with slender pubescent or puberulous petioles and rachis, and 13–23 narrow lanceolate long-pointed usually falcate finely serrate leaflets entire or nearly entire on their incurved margins, cuneate or rounded at base, thin, light green, glabrous or pubes-

Fig. 166

cent on the midrib below, 2′–3′ long and ⅓′-⅔′ wide. **Flowers:** staminate in slender aments, 3′–4′ long, pubescent when they first appear, becoming glabrous; calyx short-stalked, nearly orbicular, light yellow-green, puberulous on the outer surface, 3–5-lobed with rounded lobes, their bracts ovate-lanceolate, coated with hoary tomentum; stamens about 20, with nearly sessile yellow anthers and slightly lobed connectives; pistillate flowers oblong, narrowed at the ends, thickly coated with rufous pubescence; bract and bractlets irregularly divided into a laciniate border rather shorter than the ovate acute calyx-lobes; stigmas green tinged with red, ⅓′ long. **Fruit** globose or subglobose, tipped with the persistent remnants of the calyx, pubescent or puberulous with rusty hairs, ½′–¾′ in diameter, with a thin husk; **nut** subglobose to slightly ovoid, sometimes obscurely 4-ridged from the apex nearly to the middle (*J. subrupestris* Dode), deeply grooved with longitudinal simple or forked grooves, 4-celled at base, 2-celled at apex, thick shelled; **seed** small and sweet.

A shrubby round-headed tree occasionally 20°–30° high, with a short generally leaning

trunk 18′–30′ in diameter, usually branching from near the ground, and slender branchlets coated with pale scurfy pubescence often persistent for two or three years, orange-red and marked by pale lenticels in their first winter and ultimately ashy gray; often a shrub with clustered stems only a few feet high. **Winter-buds:** terminal, $\frac{1}{4}'$–$\frac{1}{2}'$ long, compressed, narrowed and often oblique at apex, covered with pale tomentum; axillary $\frac{1}{8}'$ long, compressed, coated with pale pubescence. **Wood** heavy, hard, not strong, rich dark brown with thick white sapwood. The beauty of the veneers obtained from the stumps of the large trees is fast causing their destruction.

Distribution. Limestone banks of the streams of southern, central and western Texas from the Rio Grande to the mountains in the western part of the state; western Oklahoma (Kiowa, Greer, Beckham, Rogel, Mills and Ellis Counties); southeastern New Mexico.

Occasionally cultivated in the eastern United States and in Europe, and hardy as far north as eastern Massachusetts; interesting as producing the smallest nuts of any of the known Walnut-trees.

5. Juglans californica S. Wats.

Leaves 6′–9′ long, with glandular pubescent petioles and rachis, and 11–15, rarely 19, oblong-lanceolate acute or acuminate glabrous finely serrate leaflets cuneate or rounded at base, 1′–$2\frac{1}{2}'$ long and $\frac{1}{3}'$–$\frac{3}{4}'$ wide, the lower often rounded at apex. **Flowers:** staminate in slender glabrous or puberulous aments 2′–3′ long; calyx puberulous on the outer surface with acute or rarely rounded lobes, its bract, puberulous; stamens 30–40, with yellow anthers and short connectives bifid at apex; the pistillate subglobose, puberulous; stigmas

Fig. 167

yellow, $\frac{1}{2}'$ long. **Fruit** globose, $\frac{1}{3}'$–$\frac{3}{4}'$ in diameter, with a thin dark-colored puberulous husk; **nut** nearly globose, deeply grooved with longitudinal grooves, thick shelled, 4-celled at base, imperfectly 2-celled at apex; **seed** small and sweet.

A shrubby round-headed tree or shrub generally 12°–20°, rarely 40°–50° high, usually branching from the ground or with a short trunk 1° or rarely 2°–3° in diameter, and slender branchlets coated with scurfy rufous pubescence when they first appear, glabrous, reddish brown and marked by pale lenticels at the end of their first season and gray the following year. **Winter-buds** coated with rufous tomentum.

Distribution. Banks of streams and bottom-lands in the southern California coast region from Santa Barbara and the Ojai valley to San Fernando and the Sierra Santa Monica, and along the foothills of the Sierra Madre to the San Bernardino Mountains and southward to the Sierra Santa Anna.

A curious seminal variety (var. *quercina* Babcock) with compound leaves composed of 3 oval leaflets, the terminal long-stalked and 2 or 3 times larger than the lateral leaflets, is occasionally cultivated in California.

6. Juglans Hindsii Rehd.

Juglans californica S. Wats., in part.

Juglans californica var. *Hindsii* Jep.

Leaves 9′–12′ long, with slender villose pubescent petioles and rachis, and 15–19, usually 19, ovate-lanceolate to lanceolate long-pointed often slightly falcate leaflets, serrate with remote teeth except toward the usually rounded cuneate or rarely cordate base, thin, puberulous above while young, becoming bright green, lustrous and glabrous on the upper

Fig. 168

surface, below furnished with conspicuous tufts of pale hairs, and villose-pubescent along the midrib and primary veins, 2½′–4′ long and ¾′–1′ wide. **Flowers**: staminate in slender glabrous or sparingly villose aments 3′–5′ long; calyx elongated, coated like its bract with scurfy pubescence, divided into 5 or 6 acute lobes; stamens 30–40, with short connectives bifid at apex; ovary of the pistillate flower oblong-ovoid, thickly covered with villose pubescence, ⅛′ long, the border of the thin bract and bractlets much shorter than the calyx-lobes; stigma yellow. **Fruit** globose, 1¼′–2′ in diameter, with a thin dark-colored husk covered with short soft pubescence; **nut** nearly globose, somewhat flattened at the ends, faintly grooved with remote longitudinal depressions, thick shelled; **seed** small and sweet.

A tree usually 30°–40°, occasionally 75° high, with a tall trunk 1°–2° in diameter, stout pendulous branches forming a narrow round-topped head, and comparatively slender branchlets thickly coated when they first appear with villose pubescence, reddish brown and puberulous, and marked by pale lenticels and small elevated obscurely 3-lobed leaf scars during their first winter, becoming darker and nearly glabrous in their second year. **Winter-buds** coated with hoary tomentum; terminal acute, compressed, more or less enlarged at apex, ¼′–⅓′ long; axillary usually solitary, nearly globose, about $\frac{1}{16}$′ in diameter. **Bark** gray-brown, smoothish, longitudinally fissured into narrow plates. **Wood** heavy, hard, rather coarse-grained, dark brown often mottled, with thick pale sapwood of from 8 to 10 layers of annual growth.

Distribution. Coast region of central California; banks of the lower Sacramento River; along streams near the western base of Mt. Diablo, and on eastern slope of the Napa Range near Atlas Peak east of Napa Valley; near Loyalton in the Sierra Valley.

Often cultivated in California as a shade tree and as stock on which to graft varieties of *Juglans regia* L., and rarely in the eastern states and in Europe. In California, a hybrid known as "Paradox" between *J. Hindsii* and *J. regia* has been artificially produced.

2. CARYA NUTT. Hickory.

Hicoria Rafn.

Trees, with smooth gray bark becoming on old trunks rough or scaly, strong hard tough brown heartwood, pale sapwood and tough terete flexible branchlets, solid pith, buds covered with few valvate or with numerous imbricated scales, the axillary buds much smaller than the terminal. Leaves often glandular-dotted, their petioles sometimes persistent on the branches during the winter, and in falling leaving large elevated oblong or semiorbicular more or less 3-lobed emarginate leaf-scars displaying small marginal clusters and central radiating lines of dark fibro-vascular bundle-scars; leaflets involute in the bud, ovate or obovate, usually acuminate, thick and firm, serrate, mostly unequal at base, with veins forked and running to the margins; turning clear bright yellow in the autumn. Aments of the staminate flowers ternate, slender, solitary or fascicled in the axils of leaves of the previous or rarely of the current year, or at the base of branches of the year from the inner scales of the terminal bud, the lateral branches in the axils of lanceolate acute persistent bracts; calyx usually 2 rarely 3-lobed, its bract free nearly to the base and usually much longer than the ovate rounded or acuminate calyx-lobes; stamens 3–10, in 2 or 3 series, their anthers ovate-oblong, emarginate or divided at apex, yellow or red, pilose or hirsute, as long or longer than their slender connectives; pistillate flowers sessile, in 2–10-flowered spikes, with a perianth-like involucre, slightly 4-ridged, unequally 4-lobed at apex, villose and covered on the outer surface with yellow scales more or less persistent on the fruit, the bract much longer than the bractlets and the single calyx-lobe; stigmas short, papillose-stigmatic. Fruit ovoid, globose or pyriform, with a thin or thick husk becoming hard and woody at maturity, 4-valved, the sutures alternate with those of the nut, sometimes more or less broadly winged, splitting to the base or to the middle; nut oblong, obovoid or subglobose, acute, acuminate, or rounded at apex, tipped by the hardened remnants of the style, narrowed and usually rounded at base, cylindric, or compressed contrary to the valves, the shell thin and brittle or thick, hard, and bony, smooth or variously rugose or ridged on the outer surface, 4-celled at base, 2-celled at apex. Seed compressed, variously grooved on the back of the flat or concave lobes, sweet or bitter.

Carya is confined to the temperate region of eastern North America from the valley of the St. Lawrence River to the highlands of Mexico, and to southern China where one species occurs. Of the seventeen species, fifteen inhabit the territory of the United States.

The generic name is from Καρύα an ancient name of the Walnut.

CONSPECTUS OF THE SPECIES OF THE UNITED STATES.

Bud-scales valvate, the inner strap-shaped and only occasionally slightly accrescent; fruit more or less broadly winged at the sutures; the thin partitions of the nut containing cavities filled with dark astringent powder (absent in 3 and 5).

Shell of the nut thin and brittle; leaflets more or less falcate.

Aments of staminate flowers nearly sessile, usually on branches of the previous year: lobes of the seed entire or slightly notched at apex.

Leaflets 9–17; nut ovoid-oblong, cylindric; seed sweet. 1. C. pecan (A, C).

Leaflets 7–13; nut oblong, compressed; seed bitter. 2. C. texana (C).

Aments of staminate flowers pedunculate, on branches of the year or of the previous year; lobes of the bitter seed deeply 2-lobed.

Leaflets 7–9; nut cylindric or slightly compressed. 3. **C. cordiformis** (A, C).

Leaflets 7–13; nut compressed, usually conspicuously wrinkled. 4. **C. aquatica** (C).

Shell of the ellipsoidal cylindric nut thick and hard; lobes of the sweet seed deeply 2-lobed; leaflets 7–9, occasionally 5, rarely slightly falcate; aments of staminate flowers long-pedunculate at the base of branches of the year. 5. **C. myristicæformis** (C).

Bud-scales imbricated, the inner becoming much enlarged and often highly colored; aments of staminate flowers on peduncles from the base of branches of the year, rarely from the axils of leaves; fruit usually without wings; partitions of the nut thick without cavities filled with astringent powder; seed sweet, its lobes deeply 2-lobed.

Branchlets usually stout (slender in 7); involucre $\frac{1}{4}'$–$\frac{1}{2}'$ in thickness, opening freely to the base.

Bark on old trunks separating into long, broad, loosely attached plates; nuts pale.

Branchlets light red-brown; shell of the nut thin.

Leaflets 5 or rarely 7, obovate to ovate, acute or acuminate; nut much compressed, often long-pointed at apex; branchlets glabrous or pubescent. 6. **C. ovata** (A, C).

Leaflets 5, lanceolate, acuminate; nut little compressed, acute at apex; branchlets slender, glabrous. 7. **C. carolinæ-septentrionalis** (C).

Branchlets pale orange color, pubescent; leaflets usually 7–9; shell of the nut thick. 8. **C. laciniosa** (A, C).

Bark not scaly, on old trunks dark, deeply ridged; leaflets 7–9, often subcoriaceous, pubescent below; nut reddish brown, often long-pointed, thick shelled; branchlets pubescent. 9. **C. alba** (A, C).

Branchlets slender; leaves 5–7-foliolate; involucre of the fruit tardily dehiscent to the middle, indehiscent or opening freely to the base; shell of the nut thick, bark close, (sometimes scaly in 13).

Branchlets and leaves not covered when they first appear with rusty brown pubescence.

Involucre of the fruit 3–5.5 mm. in thickness, opening freely to the base, leaves usually 7-foliolate; winter-buds pubescent.

Leaflets hoary tomentose below in early spring, slightly pubescent at maturity; petioles and rachis glabrous; fruit broad-obovoid; branchlets glabrous. 10. **C. leiodermis** (C).

Leaflets covered in early spring with silvery scales, pale and pubescent below during the season; petioles and rachis more or less thickly covered with fascicled hairs; fruit ellipsoidal to obovoid or globose; branchlets glabrous or slightly pubescent. 11. **C. pallida** (A, C).

Involucre of the fruit 1–3 mm. in thickness; winter-buds glabrous or puberulous.

Leaves 5, rarely 7-foliolate, glabrous or rarely slightly pubescent; fruit obovoid, often narrowed below into a stipitate base, the involucre indehiscent or tardily dehiscent. 12. **C. glabra** (A, C).

Leaves generally 7-foliolate, glabrous or rarely pubescent; fruit ellipsoidal, subglobose or obovoid, the involucre opening freely to the base; bark often more or less scaly. 13. **C. ovalis** (A, C).

Branchlets and leaves densely covered when they first appear with rusty brown pubescence; leaflets usually 5–7; winter-buds rusty pubescent.

Fruit obovoid; the involucre 2–3 mm. in thickness; peduncles of the aments of staminate flowers often from the axils of leaves; branchlets soon becoming glabrous. 14. **C. floridana** (C).

Fruit subglobose to broadly obovoid, ellipsoidal or pyriform, the involucre on the different varieties 2–13 mm. in thickness; branchlets pubescent through their first season. 15. **C. Buckleyi** (A, C).

1. Carya pecan Engl. & Graebn. Pecan.

Leaves 12′–20′ long, with slender glabrous or pubescent petioles, and 9–17 lanceolate to oblong-lanceolate more or less falcate long-pointed coarsely often doubly serrate leaflets

rounded or cuneate at the unequal base, sessile, except the terminal leaflet, or short-stalked, dark yellow-green and glabrous or pilose above, and pale and glabrous or pubescent below, 4′–8′ long, 1′–3′ wide, with a narrow yellow midrib and conspicuous veins. **Flowers:** staminate in slender puberulous clustered aments 3′–5′ long, from buds formed in the axils of leaves of the previous year or occasionally on shoots of the year, sessile or short-stalked, light yellow-green and hirsute on the outer surface, with broadly ovate acute lobes rather shorter than the oblong or obovate bract; stamens 5′ or 6′; anthers yellow, slightly villose; pistillate in few or many flowered spikes, oblong, narrowed at the ends, slightly 4-angled and coated with yellow scurfy pubescence. **Fruit** in clusters of 3–11, pointed at apex, rounded at the narrowed base, 4-winged and angled, 1′–2½′ long, ½′–1′ broad, dark brown and more or less thickly covered with yellow scales, with a thin, brittle husk splitting at maturity nearly to the base and often persistent on the branch during the winter after the discharge of the nut; **nut** ovoid to ellipsoidal, nearly cylindric or slightly 4-angled toward the pointed apex, rounded and usually apiculate at base, bright reddish brown, with irregular black markings with a thin shell and papery partitions; **seed** sweet, red-brown, its nearly flat lobes grooved from near the base to the apex by 2 deep longitudinal grooves.

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A tree, 100°–180° high, with a tall massive trunk occasionally 6° or 7° in diameter above its enlarged and buttressed base, stout slightly spreading branches forming in the forest a narrow symmetrical and inversely pyramidal head, or with abundant room a broad round-topped crown, and branchlets at first slightly tinged with red and coated with loose pale tomentum, becoming glabrous or puberulous in their first winter, and marked by numerous oblong orange-colored lenticels and by large oblong concave leaf-scars with a broad thin membranaceous border surrounding the lower axillary bud. **Winter-buds** acute, compressed, covered with clusters of bright yellow articulate hairs and pale tomentum; terminal ½′ long; axillary ovoid, often stalked, especially the large upper bud. **Bark** 1′–1½′ thick, light brown tinged with red, and deeply and irregularly divided into narrow forked ridges broken on the surface into thick appressed scales. **Wood** heavy, hard, not strong, brittle, coarse-grained, light brown tinged with red, with thin light brown sapwood; less valuable than that of most Hickories, and used chiefly for fuel, and occasionally in the manufacture of wagons and agricultural implements. The nuts, which vary in size and shape and in the thickness of their shells and in the quality of the kernels, are an important article of commerce.

Distribution. Low rich ground in the neighborhood of streams; in the valley of the Mississippi River, Iowa (Clinton and Muscatine Counties), southern Illinois, southwestern

Indiana (Sullivan and Spencer Counties), western Kentucky and Tennessee, western Mississippi and Louisiana, extreme western and southwestern Missouri (Jackson County southward, common only on the Marais de Cygne River), eastern Kansas to Kickapoo Island in the Missouri River near Fort Leavenworth, Oklahoma to the valley of the Salt Fork of the Arkansas River (near Alva, Woods County) and to creek valleys near Cache, Comanche County (*G. W. Stevens*), through Arkansas; and in Texas to the valley of the Devil's River and to that of Warder's Creek, Hardiman County; reappearing on the mountains of Mexico; most abundant and of its largest size in southern Arkansas and eastern Texas.

Largely cultivated in the Southern States, in many selected varieties, for its valuable nuts.

2. Carya texana Schn. Bitter Pecan.

Leaves 10′–12′ long, with slender petioles, and 7–13 lanceolate acuminate finely serrate leaflets, hoary-tomentose when they unfold, and more or less villose in the autumn, thin and firm, dark yellow-green and nearly glabrous above, pale yellow-green and puberulous below, 3′–5′ long, about 1½′ wide, the terminal leaflet gradually narrowed to the acute base and short-stalked, the lateral often falcate, unsymmetrical at the base, subsessile or short-

Fig. 170

stalked. **Flowers:** staminate in villose aments 2′–3′ long, light yellow-green and villose on the outer surface, with oblong-ovate rounded lobes; pistillate in few fruited spikes, oblong, slightly 4-angled, villose. **Fruit** oblong or oblong-obovoid, apiculate at apex, slightly 4-winged at base, dark brown, more or less covered with yellow scales, 1½′–2′ long, with a thin husk; **nut** oblong-ovoid or oblong-obovoid, compressed, acute at the ends, short-pointed at apex, apiculate at base, obscurely 4-angled, bright red-brown, rough and pitted, with a thin brittle shell, thin papery walls, and a low basal ventral partition; **seed** very bitter, bright red-brown, flattened, its lobes rounded and slightly divided at apex, longitudinally grooved and deeply penetrated on the outer face by the prominent reticulated folds of the inner surface of the shell of the nut.

A tree, sometimes 100° high on the bottoms of the Brazos River, with a tall straight trunk 3° in diameter, and ascending branches, or on the borders of prairies in low wet woods usually 15°–25° tall, with a short trunk 8′–10′ in diameter, small spreading branches forming a narrow round-topped head, and slender branchlets coated at first with thick hoary tomentum sometimes persistent until the autumn, bright red-brown and marked by occasional large pale lenticels during their first winter and by the large concave obcordate leaf-scars nearly surrounding the lowest axillary bud, becoming darker in their second season and dark or light gray-brown in their third year. **Winter-buds** covered with light

yellow articulate hairs; the terminal oblong, acute, or acuminate, somewhat compressed, about $\frac{1}{4}'$ long, and rather longer than the upper lateral bud. **Bark** $\frac{1}{2}'$–$\frac{2}{4}'$ thick, light reddish brown, and roughened by closely appressed variously shaped plate-like scales. **Wood** close-grained, tough and strong, light red-brown, with pale brown sapwood.

Distribution. Bottom-lands and low wet woods; valley of the lower Brazos River, Texas; near Lake Charles, Calcasieu Parish, and Laurel Hill, West Feliciana Parish, Louisiana; near Natchez, Adams County, Mississippi; valley of the Arkansas River (Arkansas Post, Arkansas County, and Van Buren, Crawford County), Arkansas.

3. Carya cordiformis K. Koch. Pignut. Bitternut.

Leaves 6′–10′ long, with slender pubescent or hirsute petioles, and 7–9 lanceolate to ovate-lanceolate or obovate long-pointed sessile leaflets coarsely serrate except at the equally or unequally cuneate or subcordate base, thin and firm, dark yellow-green and glabrous above, lighter and pubescent below, especially along the midrib, 4′–6′ long, $\frac{3}{4}'$–$1\frac{1}{4}'$ wide, or occasionally 2′–4′ wide (var. *latifolia* Sarg.). **Flowers:** staminate in slightly

Fig. 171

pubescent aments, 3′–4′ long, coated with rufous hairs like its ovate acute bract; stamens 4, with yellow anthers deeply emarginate and villose at apex; pistillate in 1 or 2-flowered spikes, slightly 4-angled, covered with yellow scurfy tomentum. **Fruit** cylindric or slightly compressed, $\frac{3}{4}'$–$1\frac{1}{2}'$ long, obovoid to subglobose, or oblong and acute at apex (var. *elongata* Ashe), 4-winged from the apex to about the middle, with a thin puberulous husk, more or less thickly coated with small yellow scales; **nut** ovoid or oblong, often broader than long, compressed and marked at base with dark lines along the sutures and alternate with them, depressed or obcordate, and abruptly contracted into a long or short point at apex, gray tinged with red or light reddish brown, with a thin brittle shell; **seed** bright reddish brown, very bitter, much compressed, deeply rugose, with irregular cross-folds.

A tree, often 100° high, with a tall straight trunk 2°–3° in diameter, stout spreading branches forming a broad handsome head, and slender branchlets marked by oblong pale lenticels, bright green and covered more or less thickly with rusty hairs when they first appear, reddish brown and glabrous or puberulous during their first summer, reddish brown and lustrous during the winter and ultimately light gray, with small elevated obscurely 3-lobed obcordate leaf-scars. **Winter-buds** compressed, scurfy pubescent, bright yellow; terminal $\frac{1}{3}'$–$\frac{3}{4}'$ long, oblique at apex, with 2 pairs of scales; lateral 2-angled, often stalked, $\frac{1}{8}'$–$\frac{1}{4}'$ long, with ovate pointed slightly accrescent scales keeled on the back. **Bark** $\frac{1}{3}'$–$\frac{3}{4}'$ thick, light brown tinged with red, and broken into thin plate-like scales sepa-

rating on the surface into small thin flakes. **Wood** heavy, very hard, strong, tough, close-grained, dark brown, with thick light brown or often nearly white sapwood; largely used for hoops and ox-yokes, and for fuel.

Distribution. Low wet woods near the borders of streams and swamps or on high rolling uplands often remote from streams, southern Maine to Quebec and Ontario, the northern shores of the Lower Peninsula of Michigan, northern Minnesota, southeastern Nebraska, eastern Kansas, eastern Oklahoma, and southward to northwestern Florida, Dallas County, Alabama, West Feliciana Parish, Louisiana, and eastern Texas; generally distributed, but not very abundant in all the central states east and west of the Appalachian Mountains; ranging farther north than the other species, and growing to its largest size on the bottom-lands of the lower Ohio basin; the common Hickory of Iowa, Nebraska, and Kansas. Very common in West Feliciana Parish, and up to 170 feet in height (*R. S. Cocks*).

A natural hybrid, × *C. Brownii* Sarg. of *C. cordiformis* with *C. pecan*, with characters intermediate between those of its supposed parents, occurs on bottom-land of the Arkansas River near Van Buren, Crawford County, Arkansas; Missouri (Richards, Vernon County) and Kansas (Arkansas City, Cowley County). Probably of the same parentage is the so-called Galloway Nut found in Hamilton County, Ohio. Another hybrid, × *C. Brownii* var. *varians* Sarg., probably of the same parentage also, occurs near Van Buren, Arkansas, and near Natchez, Mississippi, × *C. Laneyi* Sarg., a natural hybrid evidently of *C. cordiformis* with *C. ovata*, has been found in Rochester, New York, and trees considered varieties of the same hybrid, var. *chateaugayensis* Sarg., occur near the mouth of the Chateaugay River, Province of Quebec, and at Summertown, Ontario.

4. Carya aquatica Nutt. Water Hickory.

Leaves 9′–15′ long, with slender dark red puberulous or tomentose petioles, and 7–13 ovate-lanceolate long-pointed falcate leaflets symmetrical and rounded or cuneate and unsymmetrical and oblique at base, finely or coarsely serrate, sessile or stalked, 3′–5′ long,

Fig. 172

½′–1½′ wide, covered with yellow glandular dots, thin, dark green above, brown and lustrous or tomentose on the lower surface, especially on the slender midrib and primary veins, the terminal leaflet more or less decurrent by its wedge-shaped base on a slender stalk or rarely nearly sessile. **Flowers:** staminate in solitary or fascicled hirsute aments 2½′–3′ long, covered like their bract with yellow glandular pubescence; stamens 6, with yellow puberulous antlers; pistillate in several flowered spikes, oblong, slightly flat-

tened, 4-angled, glandular-pubescent. **Fruit** often in 3 or 4-fruited clusters, much compressed, usually broadest above the middle, rounded at the slightly narrowed base, rounded or abruptly narrowed at apex, conspicuously 4-winged, dark brown or nearly black, covered more or less thickly with bright yellow scales, $1\frac{1}{2}'$ long, $1'$–$1\frac{1}{4}'$ wide, with a thin brittle husk splitting tardily and usually only to the middle; **nut** flattened, slightly obovoid, nearly as broad as long, rounded and abruptly short-pointed at apex, rounded at the narrow base, 4-angled and ridged, dark reddish brown, and longitudinally and very irregularly wrinkled, with a thin shell; **seed** oblong, compressed, dark brown, irregularly and usually longitudinally furrowed, very bitter.

A tree, occasionally 80°–100° high, with a trunk rarely exceeding 2° in diameter, slender upright branches forming a narrow head, and slender dark reddish brown or ashy gray lustrous branchlets marked by numerous pale lenticels, at first slightly glandular and coated with loose pale tomentum, glabrous or puberulous during the summer, and marked during the winter by small nearly oval or obscurely 3-lobed slightly elevated leaf-scars, growing dark red-brown and ultimately gray. **Winter-buds** slightly flattened, acute, dark reddish brown, covered with caducous yellow scales; terminal $\frac{1}{8}'$–$\frac{1}{4}'$ long, often villose; axillary much smaller, frequently nearly sessile, often solitary. **Bark** $\frac{1}{2}'$–$\frac{2}{3}'$ thick, separating freely into long loose plate-like light brown scales tinged with red. **Wood** heavy, strong, close-grained, rather brittle, dark brown, with thick light-colored or often nearly white sapwood; occasionally used for fencing and fuel.

Distribution. River swamps often inundated during a considerable part of the year from southeastern Virginia southward through the coast regions to the shores of Indian River and the valley of the Suwanee River, Florida, through the maritime portions of the Gulf states to the valley of the Brazos River, Texas, and northward through western Louisiana to southeastern Missouri, and to northeastern Louisiana, western Mississippi, and southern Illinois; passing into the var. *australis* Sarg. with narrower leaflets, smaller ellipsoidal fruit, pale red-brown nuts without longitudinal wrinkles, and with close not scaly bark of the trunk. A large tree in dry sandy soil; high banks of the St. John's River, near San Mateo, Putnam County, near Jupiter, Palm Beach County, banks of the Caloosahatchee River at Alva and La Belle, Lee County, and Old Town, Dixie County, Florida; near Marshall, Harrison County, Texas.

5. Carya myristicæformis Nutt. Nutmeg Hickory.

Leaves 7′–14′ long, with slender terete scurfy-pubescent petioles, and 7–9, occasionally 5, ovate-lanceolate to broadly obovate acute leaflets usually equally or sometimes unequally cuneate or rounded at the narrow base, coarsely serrate, short-stalked or nearly

Fig. 173

sessile, thin and firm, dark green above, more or less pubescent or nearly glabrous and silvery white and very lustrous below, 4′–5′ long, 1′–1½′ wide, with a pale scurfy pubescent midrib; changing late in the season to bright golden-bronze color and then very conspicuous. **Flowers:** staminate in aments 3′–4′ long and coated like the ovate-oblong acute bract and calyx of the flower with dark brown scurfy pubescence; stamens 6, with yellow anthers; pistillate oblong, narrowed at the ends, slightly 4-angled, covered with thick brown scurfy pubescence. **Fruit** usually solitary, ellipsoidal or slightly obovoid, 4-ridged to the base, with broad thick ridges, 1½′ long, coated with yellow-brown scurfy pubescence, the husk not more than $\frac{1}{32}$′ thick, splitting nearly to the base; **nut** ellipsoidal or sometimes slightly obovoid, 1′ long, $\frac{3}{4}$′ broad, rounded and apiculate at the ends, smooth, dark reddish brown, and marked by longitudinal broken bands of small gray spots covering the entire surface at the ends with a thick hard and bony shell, a thick partition, and a low thin dorsal division; **seed** sweet, small, dark brown; the lobes deeply 2-lobed at apex.

A tree, 80°–100° high, with a tall straight trunk often 2° in diameter, stout slightly spreading branches forming a comparatively narrow rather open head, and slender branchlets coated with lustrous golden or brown scales often persistent until the second year, light brown or ashy gray during their first winter, ultimately dark reddish brown, and marked by small scattered pale lenticels and small oval emarginate elevated leaf-scars. **Winter-buds** covered with thick brown scurvy pubescence; terminal $\frac{1}{8}$′–$\frac{1}{4}$′ long, ovoid, rather obtuse; axillary much smaller, acute, slightly flattened, sessile or short-stalked, often solitary. **Bark** $\frac{1}{2}$′–$\frac{3}{4}$′ thick, dark brown tinged with red, and broken irregularly into small thin appressed scales. **Wood** hard, very strong, tough, close-grained, light brown, with thick lighter colored sapwood of 80–90 layers of annual growth.

Distribution. Banks of rivers and swamps in rich moist soil or rarely on higher ground; eastern South Carolina, central Alabama, eastern, and northwestern (bluffs of the Yazoo River at Yazoo City) Mississippi, southern and central Arkansas northward to Faulkner County, western Louisiana, southeastern Oklahoma to Clear Boggy Creek, western Choctaw County, and in Beaumont County, Texas; on the mountains of northeastern Mexico; rare and local; abundant only near Selma, Alabama, and in southern Arkansas.

6. Carya ovata K. Koch. Shellbark Hickory. Shagbark Hickory.

Leaves 8′–14′ long, with stout glabrous or pubescent petioles, and 5 or rarely 7 ovate to ovate-lanceolate or obovate leaflets, acuminate or rarely rounded at apex, more or less

Fig. 174

thickly ciliate on the margins, finely serrate except toward the usually cuneate base, dark yellow-green and glabrous above, paler, glabrous and lustrous or puberulous below, the terminal leaflet decurrent on a slender stalk, 5′–7′ long, 2′–3′ wide, rather larger than the

sessile or short-stalked upper leaflets, and two or three times as large as those of the lowest pair. **Flowers:** staminate opening after the leaves have grown nearly to their full size, in slender light green glandular-hirsute aments 4′–5′ long, glandular-hirsute, their elongated ovate-lanceolate acute bract two or three times as long as the ovate concave rounded or acute calyx-lobes; stamens 4, with yellow or red anthers hirsute above the middle; pistillate in 2–5-flowered spikes, $\frac{1}{3}$′ long, clothed with rusty tomentum. **Fruit** solitary or in pairs, subglobose, rather longer than broad or slightly obovoid, depressed at apex, dark reddish brown or nearly black at maturity, roughened by small pale lenticels, glabrous or pilose, 1′–$2\frac{1}{2}$′ long, the husk, $\frac{1}{8}$′–$\frac{1}{2}$′ thick, splitting freely to the base; **nut** oblong, nearly twice as long as broad, or obovoid and broader than long, compressed, prominently or obscurely 4-ridged and angled, acute and gradually or abruptly narrowed or rounded or nearly truncate at apex, gradually narrowed and rounded at base, pale or nearly white, with a usually thin shell; **seed** light brown, lustrous, sweet, with an aromatic flavor.

A tree, 70°–90° and occasionally 120° high, with a tall straight trunk 3°–4° in diameter, in the forest often free of branches for 50°–60° above the ground and then divided into a few small limbs forming a narrow head, or with more space sometimes dividing near the ground or at half the height of the tree into stout slightly spreading limbs, forming a narrow inversely conic round-topped head of more or less pendulous branches, and stout branchlets marked with oblong pale lenticels, covered at first with caducous brown scurf and coated with pale glandular pubescence, soon bright reddish brown, and lustrous, glabrous or pubescent, growing dark gray in their second year and ultimately light gray, and marked by pale and slightly elevated ovate semiorbicular or obscurely 3-lobed leaf-scars. **Winter-buds:** terminal broadly ovoid, rather obtuse, $\frac{1}{2}$′–$\frac{3}{4}$′ long, $\frac{1}{3}$′–$\frac{1}{2}$′ broad, the 3 or 4 outer scales nearly triangular, acute, dark brown, pubescent and hirsute on the outer surface, the exterior scales often abruptly narrowed into long rigid points and deciduous before the unfolding of the leaves, the inner scales lustrous, covered with resinous glands, yellow-green often tinged with red, oblong-obovate, pointed, becoming $2\frac{1}{2}$′–3′ long and $\frac{1}{2}$′ broad, usually persistent until after the fall of the staminate aments; axillary buds coated at first with thick white tomentum, becoming $\frac{1}{3}$′–$\frac{1}{2}$′ long when fully grown. **Bark** light gray, $\frac{3}{4}$′–1′ thick, separating in thick plates often a foot or more long and 6′–8′ wide, and more or less closely attached to the trunk by the middle, giving it the shaggy appearance to which this tree owes its common name. **Wood** heavy, very hard and strong, tough, close-grained, flexible, light brown, with thin nearly white sapwood; largely used in the manufacture of agricultural implements, carriages, wagons, and for axe-handles, baskets, and fuel. The nut is the common Hickory nut of commerce.

Distribution. Low hills and the neighborhood of streams and swamps in rich deep moderately moist soil; southern Maine to the valley of the St. Lawrence River near Montreal, along the northern shores of Lakes Erie and Ontario to central Michigan, central Wisconsin, southeastern Minnesota, eastern Iowa and southeastern Nebraska, and southward to western Florida, northern Alabama and Mississippi, and to eastern Kansas, eastern Oklahoma, and eastern Texas; ranging further north than other Hickories with the exception of *C. cordiformis;* and in the Carolinas ascending to 3000° above the sea in valleys on the western slope of the Blue Ridge. Variable in the size and shape of the nut and in the character and amount of pubescence on the leaves and branchlets. These varieties are distinguished: var. *Nuttallii* Sarg., with nuts rounded, obcordate or rarely pointed at apex, rounded or abruptly pointed at base, much compressed, and only about $\frac{3}{5}$′ long and $\frac{2}{5}$′–$\frac{1}{2}$′ broad; not rare and widely distributed northward. Var. *complanata* Sarg., with oblong-obovoid fruit and broadly obovoid much compressed slightly angled nuts cuneate at base and rounded, truncate or slightly obcordate at apex; a single tree on the Drushel Farm near Mt. Hope, Holmes County, Ohio. Var. *ellipsoidalis* Sarg., with ellipsoidal much compressed nuts abruptly long-pointed at apex, and slender reddish branchlets; near Hannibal, Marion County, and Oakwood, Rolles County, northeastern Missouri, and Indian River, Lewis County, and near Rochester, Monroe County, New York. Var. *pubescens* Sarg., differing in the dense pubescence of pale fascicled hairs on the young branchlets, and on the petioles, rachis and under surface of the leaflets; bottoms of the

Savannah River, Calhoun Falls, Abbeville County, South Carolina, bottoms of Little River, Walker County, Georgia, Chattanooga Creek, Hamilton County, Tennessee, Valley Head, DeKalb County, Alabama, and Columbus, Lowndes County, Starkville, Oktibbeha County, and Brookville, Noxubee County, Mississippi. More distinct is

Carya ovata var. fraxinifolia Sarg.

Leaves 7′–9′ long, with slender glabrous or puberulous petioles and 5 lanceolate to slightly oblanceolate acuminate finely serrate leaflets glabrous except on the under side of the midrib, the terminal leaflet 4′–7′ long and 1½′–1′ wide, the lateral sessile, unsymmetrical at base, those of the upper pair often larger than the terminal leaflet, those of the lower pair 2′–2½′ long and 1′–1¼′ wide. **Flowers** as in the species. **Fruit** obovoid, usually rounded at apex, compressed, about 1¼′ long, the husk splitting freely to the base, ⅛′–¼′ in thickness; **nut** much compressed, rounded at the ends, prominently angled.

Fig. 175

A large tree with bark separating in long loose plates, and slender reddish glabrous or puberulous branchlets.

Distribution. Near Rochester, Monroe County, New York; common; near Kingston, Ontario, and westward through Ohio and Indiana; at Keosauqua, Van Buren County, Iowa, and near Myers, Osage County, Oklahoma.

7. Carya carolinæ-septentrionalis Engl. & Graebn. Shagbark Hickory.

Leaves 4′–8′ long, with slender glabrous petioles, and usually 5 but occasionally 3 lanceolate long-pointed leaflets gradually narrowed at the acuminate symmetrical or unsymmetrical base, coarsely serrate, ciliate with long white hairs as the leaves unfold, thin, dark green above, pale yellow-green and lustrous below, the upper leaflets 3′–4′ long, 1′–1½′ wide, and about twice as large as those of the lower pair, turning dull brown or yellow-brown some time before falling. **Flowers:** staminate in slightly villose aments, glandular-hirsute on the outer surface, with linear elongated acuminate villose bracts; stamens 4; anthers puberulous; pistillate usually in 2-flowered spikes, oblong and covered with clustered golden hairs, their bract linear and ciliate on the margins. **Fruit** broader than high, or short-oblong, slightly depressed at apex, ¾′–1½′ wide, dark red-brown, roughened by small pale lenticels, the husk ⅛′–⅜′ thick, splitting freely almost to the base; **nut** ovoid, compressed, prominently 4-angled, acute at ends, nearly white or pale brown, with a thin shell; **seed** light brown, sweet.

A tree, on moist bottom-lands sometimes 80° tall, with a trunk 2°–3° in diameter, and

short small branches forming a narrow oblong head, or on dry hillsides usually not more than 20°–30° tall, with a trunk generally not exceeding a foot in diameter, and slender red-brown branchlets marked by numerous small pale lenticels and by the small low truncate or slightly obcordate leaf-scars, becoming ultimately dull gray-brown. **Winter-buds:** terminal ovoid, gradually narrowed to the obtuse apex, about $\frac{1}{4}'$ long, with glabrous bright red-brown and lustrous acute and apiculate strongly keeled spreading outer scales, the inner scales becoming when fully grown bright yellow, long-pointed, and sometimes 2′

Fig. 176

long; axillary buds oblong, obtuse, not more than $\frac{1}{16}'$ long. **Bark** light gray, $\frac{1}{4}'$–$\frac{3}{4}'$ thick, separating freely into thick plates often a foot or more long, 3′ or 4′ wide, and long-persistent, giving to the trunk the shaggy appearance of the northern Shagbark Hickory. **Wood** hard, strong, very tough, light reddish brown, with thin nearly white sapwood.

Distribution. Dry limestone hills, river-bottoms and low flat often inundated woods, frequently in clay soil; central North Carolina to northern Georgia, and through western North Carolina to eastern Tennessee, eastern Mississippi, and in Cullman and Dallas Counties, Alabama.

8. Carya laciniosa Loud. Big Shellbark. King Nut.

Leaves 15′–22′ long, with stout glabrous or pubescent petioles often persistent on the branches during the winter, and 5–9, usually 7, ovate to oblong-lanceolate or broadly obovate leaflets, the upper 5′–9′ long and 3′–5′ wide and generally two or three times as large as those of the lowest pair, usually equilateral and acuminate at apex, equally or unequally cuneate or rounded at the often oblique base, finely serrate, sessile or short-stalked, dark green and lustrous above, pale yellow-green or bronzy brown and covered with soft pubescence below. **Flowers:** staminate in aments 5′–8′ long, glabrous or covered with rufous scurfy tomentum, with linear-lanceolate acute bracts two or three times as long as the broad rounded calyx-lobes; anthers hirsute, yellow, more or less deeply emarginate; pistillate in 2–5-flowered spikes, oblong-ovoid, about twice as long as broad, slightly angled, clothed with pale tomentum, their linear bracts acute much longer than the nearly triangular bractlets and calyx-lobe. **Fruit** solitary or in pairs, ellipsoidal, ovoid or subglobose, depressed at apex, roughened with minute orange-colored lenticels, downy or glabrous, light orange-colored or dark chestnut-brown at maturity, $1\frac{3}{4}'$–$2\frac{1}{2}'$ long and $1\frac{1}{4}'$–2′ broad, with a hard woody husk pale and marked on the inside with dark delicate veins, and $\frac{1}{4}'$–$\frac{1}{3}'$ thick; **nut** ellipsoidal or slightly obovoid, longer than broad or sometimes broader than long, flattened and rounded at the ends, or gradually narrowed and rounded at base

and occasionally acuminate at apex, more or less compressed, prominently 4-ridged and angled or often 6-ridged, furnished at base with a stout long point, light yellow to reddish brown, $1\frac{1}{4}'$–$2\frac{1}{2}'$ long and $1\frac{1}{2}'$–$1\frac{3}{4}'$ wide, with a hard bony shell sometimes $\frac{1}{4}'$ thick; seed light chestnut-brown, very sweet.

A tree, occasionally 120° high, with a straight slender trunk often free of branches for more than half its height and rarely exceeding 3° in diameter, comparatively small spreading branches forming a narrow oblong head, and stout dark or light orange-colored branchlets at first pilose or covered with pale or rufous pubescence or tomentum, roughened by scattered elevated long pale lenticels, orange-brown and glabrous or puberulous during their first winter, and marked by oblong 3-lobed emarginate leaf-scars. **Winter-buds:** terminal ovoid, rather obtuse, sometimes 1′ long and $\frac{3}{8}'$ wide, and three or four times as large as the axillary buds, usually covered by 11 or 12 scales, the outer dark brown, puberulous, generally keeled, with a long point at apex, the inner scales obovate, pointed or rounded at apex, light green tinged with red, or bright red or yellow, covered with silky pubescence on the outer face, slightly resinous, becoming 2′–3′ long and 1′ wide. **Bark** 1′–2′ thick, light gray, separating into broad thick plates frequently 3°–4° long, sometimes

Fig. 177

remaining for many years hanging on the trunk. **Wood** heavy, very hard, strong and tough, close-grained, very flexible, dark brown, with comparatively thin nearly white sapwood. The large nuts are often sold in the markets of western cities and commercially are not often distinguished from those of the Shellbark Hickory.

Distribution. Rich bottom-lands usually inundated during several weeks of every year; central and western New York and southeastern Ontario, and westward through southern Ohio, southern Michigan, Indiana and Illinois to southeastern Iowa and southeastern Nebraska, through Missouri and Arkansas to southeastern Kansas and northeastern Oklahoma, and southward through eastern Pennsylvania to western West Virginia; in southeastern Tennessee; banks of the Alabama River, Dallas County, Alabama, and in West Feliciana Parish, Louisiana.

× *Carya Nussbaumerii* Sarg. with leaves like those of *C. laciniosa*, slender branchlets, and large fruit of the shape of that of the Pecan but without sutural wings and white or nearly white nuts, believed to be a hybrid of these species, has been found near Fayetteville, St. Clair County, Illinois, at Mt. Vernon, Posey County, Indiana, near Burlington, Des Moines County, Iowa, and from the neighborhood of Rockville, Bates County, Missouri.

Trees intermediate in character between *C. laciniosa* and *C. ovata* growing on the bottoms of the Genessee River at Golah, Monroe County, New York, and believed to be hybrids of these species, are × *C. Dunbarii* Sarg.

9. Carya alba K. Koch. Hickory.

Leaves glandular, resinous, fragrant, 8′–12′ long, with petioles covered like the rachis and the under surface of the leaflets with fascicled hairs, and 5 or 7 oblong-lanceolate to obovate-lanceolate leaflets gradually or abruptly acuminate, mostly equilateral, equally or unequally rounded or cuneate at base, minutely or coarsely serrate, sessile or short-stalked, dark yellow-green and rather lustrous above, lustrous, paler or light orange-colored or brown on the lower surface, the upper leaflets 5′–8′ long and 3′–5′ wide, and two or three times as large as those of the lowest pair. **Flowers:** staminate in aments 4′–5′ long, with slender light green stems coated with fascicled hairs, pale yellow-green, scurfy-pubescent, with elongated ovate-lanceolate bracts ending in tufts of long pale hairs, and three or four times as long as the calyx-lobes; stamens 4, with oblong bright red hirsute anthers; pistillate in crowded 2–5-flowered spikes, slightly contracted above the middle, coated with pale tomentum, the bract ovate, acute, sometimes $\frac{1}{4}'$ long, about twice as long as the broadly ovate nearly triangular bractlets and calyx-lobes; stigmas dark red. **Fruit** ellipsoidal or obovoid, gradually narrowed at the ends, acute at apex, abruptly contracted toward the base, rarely obovoid with a stipe-like base

Fig. 178

(var. *ficoides* Sarg.), or ovoid with a long acuminate apex (var. *ovoidea* Sarg.), pilose or nearly glabrous, dark red-brown, $1\frac{1}{2}'$–$2'$ long, with a husk about $\frac{1}{8}'$ thick splitting to the middle or nearly to the base; **nut** nearly globose, ellipsoidal, obovoid-oblong or ovoid, narrowed at ends, rounded at base, acute, and sometimes attenuated and long-pointed at apex, much or only slightly compressed, obscurely or prominently 4-ridged, light reddish brown, becoming darker and sometimes red with age, with a very thick hard shell and partitions; in drying often cracking transversely; **seed** small, sweet, dark brown, and lustrous.

A tree, rarely 100° high, usually much smaller, with a tall trunk occasionally 3° in diameter, comparatively small spreading branches forming a narrow or often a broad round-topped head of upright rigid or of gracefully pendulous branches, and stout branchlets clothed at first with pale fascicled hairs, rather bright brown, nearly glabrous or more or less pubescent, and marked by conspicuous pale lenticels during their first season, becoming light or dark gray, with pale emarginate leaf-scars almost equally lobed, or elongated with the lowest lobe two or three times as long as the others. **Winter-buds:** terminal broadly ovoid, acute or obtuse, $\frac{1}{2}'$–$\frac{3}{4}'$ long, two or three times as large as the axillary buds, the three or four outer bud-scales ovate, acute, often keeled and apiculate, thick and firm, dark reddish brown and pilose, usually deciduous late in the autumn, the inner scales

ovate, rounded or acute and short-pointed at apex, light green covered with soft silky pubescence on the outer, and often bright red and pilose on the inner surface, becoming 1′–1½′ long and ½′ broad. **Bark** ½′–¾′ thick, close, slightly ridged by shallow irregular interrupted fissures and covered by dark gray closely appressed scales. **Wood** very heavy, hard, tough, strong, close-grained, flexible, rich dark brown, with thick nearly white sapwood; used for the same purposes as that of the Shellbark Hickory.

Distribution. Eastern Massachusetts southward to Lake County, Florida, and eastern Texas, and through Ohio, southwestern Ontario, southern Michigan, Illinois and Indiana to southeastern Iowa, and through Missouri to eastern Oklahoma; comparatively rare at the north, growing on dry slopes and ridges and less commonly on alluvial bottomlands; absent from eastern Canada, northern and western New England, and New York except in the neighborhood of the coast; the most abundant and generally distributed Hickory-tree of the southern states, growing to its largest size in the basin of the lower Ohio River and in Missouri and Arkansas; commonly in southern Arkansas and eastern Texas, and occasionally in other southern states represented by var. *subcoriacea* Sarg., differing in its larger, thicker, more pubescent leaflets, more prominently angled fruit with a thicker husk, larger nuts, and in its longer winter-buds often ⅘′ long and ¾′ in diameter.

× *Carya Schneckii* Sarg., believed to be a hybrid of *C. alba* and *C. pecan*, has been found at Lawrenceville, Lawrence County, Illinois, and near Muscatine, Muscatine County, Iowa.

10. Carya leiodermis Sarg.

Leaves 12′–14′ long, with slender petioles and rachis slightly or densely pubescent with fascicled hairs, becoming glabrous or nearly glabrous, and 7 or rarely 5 thin finely serrate leaflets, long-pointed at apex, and gradually narrowed, cuneate and unsymmetrical at base,

Fig. 179

at first hoary tomentose below and pubescent above, becoming dark green and lustrous on the upper surface and pale and slightly pubescent on the lower surface, especially on the stout midrib, the terminal oblong-obovate with a stalk ½′–⅘′ in length, or nearly sessile, of the same shape and often smaller than the nearly sessile upper leaflets, 4′–5′ long and 2′–2½′ wide, and much larger than the lanceolate lower leaflets. **Flowers:** staminate opening after the leaves have grown nearly to their full size, in slender puberulous aments

4′–4½′ long; bract of the flower ovate, lanceolate, ciliate on the margins with long white hairs mixed with stipitate glands, a third longer than the ciliate calyx-lobes; stamens 4, anthers red, covered with long rigid white hairs; pistillate in short spikes, their involucre and bracts densely clothed with white hairs. **Fruit** broadly obovoid, smooth, glabrous or puberulous, covered with scattered white scales, 1½′–1¾′ long, about 1¼′ in diameter, the husk ⅛′ to nearly ¼′ thick, opening freely to the base usually only by two sutures; **nut** ellipsoidal or slightly obovoid, little compressed, rounded at the ends, tinged with red, with a shell ⅛′–⅕′ thick; **seed** small and sweet.

A tree 60°–75° tall with a trunk occasionally 3° in diameter, stout often pendulous branches forming a narrow round-topped head, and slender reddish brown lustrous branchlets puberulous or pubescent when they first appear, becoming glabrous or nearly glabrous by the end of their first season. **Winter-buds:** terminal acute, about ½′ long, the outer scales pubescent, the inner covered with appressed pale hairs and ciliate on the margins; axillary buds ovoid and rounded at apex or subglobose. **Bark** close, pale, only slightly ridged.

Distribution. Low wet woods; Louisiana to southern Arkansas, and in northwestern Mississippi (bluffs, Yazoo County); most abundant in western Louisiana from the neighborhood of the coast to the valley of Red River, and in Tangipahoa Parish east of the Mississippi River.

Passing into var. *callicoma* Sarg., differing in the thinner husk of the fruit and in the bright red color of the unfolding leaves.

Distribution. Low wet woods; valley of the Calcasieu River (near Lake Charles), western Louisiana to that of the Neches River (near Beaumont), Texas; in western and southern Mississippi (Warren, Adams, Hinds, Lafayette, Copiah, Lowndes and Oktibbeha Counties).

11. Carya pallida Engl. & Graebn.

Leaves 7′–15′ long, with slender petioles and rachis covered, like the under side of the midrib, with prominent persistent clusters of fascicled hairs mixed with silvery scales, and

Fig. 180

usually 7, rarely 9, lanceolate or oblanceolate leaflets, the terminal rarely obovate, finely serrate, resinous, fragrant, acuminate and long-pointed at apex, cuneate or rounded and often unsymmetrical at base, covered in spring with small silvery peltate scales, and at maturity light green and lustrous above, pale and pubescent or puberulous below, the terminal short-stalked or nearly sessile, 4′–6′ long and 1′–2′ wide, and as large or slightly larger than the upper lateral leaflets, those of the lower pairs usually not more than 2′ long and

$\frac{1}{2}'$ wide. **Flowers:** staminate in aments covered with fascicled hairs and silvery scales, $2\frac{1}{2}'$–$5'$ long, puberulous and glandular on the outer surface, with linear acuminate bracts; stamens 4, anthers hirsute; pistillate usually solitary, oblong, covered with yellow scales, their bract ovate-lanceolate, ciliate on the margin. **Fruit** pubescent and covered with yellow scales, ellipsoidal to obovoid, broad-obovoid, subglobose to depressed-globose, and from $\frac{1}{2}'$–$1\frac{1}{2}'$ in length, with a husk from $\frac{1}{8}'$–$\frac{1}{6}'$ in thickness, splitting tardily to the base by 2 or 3 of the sutures, or occasionally remaining unopened until midwinter; **nut** white, rounded at the ends, or obcordate or obtusely pointed at apex, compressed, more or less prominently ridged nearly to the base, with a shell $\frac{1}{8}'$–$\frac{1}{12}'$ thick; **seed** small and sweet.

A tree occasionally 90°–110° high, with a tall trunk $2\frac{1}{2}°$–$3°$ in diameter, usually not more than 30°–40° tall, with a trunk 12′–18′ in diameter, stout branches, the upper erect, the lower often pendulous, and slender red-brown glabrous or pubescent branchlets. **Winter-buds** acute or obtuse, reddish brown, puberulous and covered with silvery scales, the terminal $\frac{1}{4}'$ long with 6–9 scales and rather larger than the lateral buds usually covered with fewer scales. **Bark** of large trees grown in good soil pale and slightly ridged, that of trees on dry ridges, rough, deeply furrowed, dark gray and southward often nearly black. **Wood** brown with nearly white sapwood; probably little used except as fuel.

Distribution. Sandy soil in the neighborhood of Cape May, New Jersey, in southern Delaware, and in the southern part of the Maryland peninsula; common in rich soil in Gloucester and James City Counties, Virginia, growing here to its largest size, and southward from southeast Virginia through the Piedmont region of North and South Carolina, ascending to altitudes of 2200° in the mountain valleys of these states; common in northern and central Georgia and southeastern Tennessee, occasionally reaching the Georgia coast and the southwestern part of that state; in western Florida, through northern and central Alabama to Dallas County, and through southern Mississippi to northeastern Louisiana (near Kentwood, Tangipahoa Parish); in Mississippi extending northward to the valley of the Yazoo River in Yazoo County; in southern Tennessee (Lexington, Henderson County); in Alabama the common Hickory on the dry gravelly and poor soils of the upland table-lands and ridges of the central part of the state.

12. Carya glabra Sweet. Pignut.

Carya porcina Nutt.

Leaves 8′–12′ long, with slender glabrous petioles and rachis, and 5 or rarely 7 lanceolate or oblanceolate finely serrate leaflets acuminate at the ends, yellow-green and glabrous above, glabrous, or pubescent on the midrib below, the terminal leaflet sometimes obovate, 4′–$4\frac{1}{2}'$ long and 5′ or 6′ wide, and raised on a glabrous or sparingly pubescent stalk, $\frac{1}{4}'$–$\frac{1}{2}'$ in length, the lateral leaflets sessile, those of the upper pair about the size of the terminal leaflet, and two or three times larger than those of the lower pair. **Flowers:** staminate in short-stalked pubescent aments $2'$–$2\frac{1}{2}'$ long, yellow-green, the bract villose, much longer than the calyx-lobes; stamens 4, anthers yellow, villose toward the apex; pistillate in few-flowered spikes, oblong, coated with hoary tomentum like the lanceolate acuminate bract. **Fruit** obovoid, compressed, rounded at apex, gradually narrowed below and often abruptly contracted into a stipe-like base, about 1′ long and $\frac{3}{4}'$ wide, with a husk from $\frac{1}{12}'$–$\frac{1}{8}'$ in thickness, opening late by one or two sutures or often remaining closed; **nut** obovoid, compressed, without ridges, rounded or slightly obcordate at apex, gradually narrowed and rounded below, with a hard thick shell; **seed** small and sweet.

A tree 60°–90° high, with a trunk $2°$–$2\frac{1}{2}°$ in diameter, with small spreading often drooping branches forming a tall narrow head, and slender glabrous reddish branchlets marked by pale lenticels. **Winter-buds** ovoid, acute, light brown, glabrous, $\frac{1}{3}'$–$\frac{1}{2}'$ long and $\frac{1}{5}'$–$\frac{1}{4}'$ in diameter, the inner scales covered with close pubescence. **Bark** close, ridged, light gray. **Wood** heavy, hard, strong and tough, flexible, light or dark brown, with thick lighter-colored sapwood; used for the handles of tools and in the manufacture of wagons and agricultural implements, and largely for fuel.

Distribution. Hillsides and dry ridges; southwestern Vermont to western New York, southeastern Ontario, southern Indiana and southwestern Illinois, and southward to Dela-

Fig. 181

ware, the District of Columbia and eastern Virginia, and along the Appalachian Mountains to North Carolina; in northern, central and eastern Georgia, northern Alabama and eastern Mississippi.

The name "Pignut" usually applied to this tree and to the forms of *C. ovalis* Sarg., especially in the north, properly belongs to *C. cordiformis* Schn.

Passing into

Carya glabra var. megacarpa Sarg.

Carya megacarpa Sarg.

Leaves 12′–14′ long, with slender glabrous petioles and 5–7 lanceolate to oblanceolate leaflets long-pointed and acuminate at apex, gradually narrowed and unsymmetrical at base, finely serrate, glabrous or very rarely pubescent, often furnished below with small clusters of axillary hairs, the three upper 8′–10′ long and 1½′–2½′ wide and about twice as large as those of the lowest pair. **Flowers:** staminate in slightly villose aments 2½′–3′ in length, villose, their bract long-pointed, acuminate, villose, twice longer than the calyx-lobes, stamens 4–6, anthers yellow, villose above the middle; pistillate in short-stalked spikes, their involucre only slightly angled, covered with pale yellow hairs, the bract acuminate, twice longer than the bractlets and calyx-lobes. **Fruit** oblong-obovoid with a stipe-like base to short-obovate and rounded or abruptly cuneate at base, rarely depressed at apex, slightly flattened, often covered with bright yellow scales, 1′–2′ long, 1′–1½′ in diameter, with a husk ⅛′–⅕′ in thickness, opening tardily to the middle usually by one or by two sutures, or often remaining closed; **nut** broadest toward the rounded apex or oblong and occasionally acute at apex, gradually narrowed and acute at base, often compressed, slightly or rarely prominently angled (f. *angulata* Sarg.), with a shell ⅛′–⅙′ in thickness; **seed** small and sweet.

A tree 50°–70° high, with a trunk up to 2° in diameter, stout spreading and drooping branches, and stout or rarely slender glabrous branchlets, reddish brown at the end of their

first season, becoming dark gray-brown. **Winter-buds** ovoid, acute, glabrous, up to $\frac{1}{2}'$ in length, the inner scales puberulous. **Bark** close, only slightly ridged, light or dark gray.

Distribution. Rochester, Monroe County, New York, through southern Ohio and Indiana to southern Illinois (Tunnel Hill, Johnson County); coast of New Jersey; District

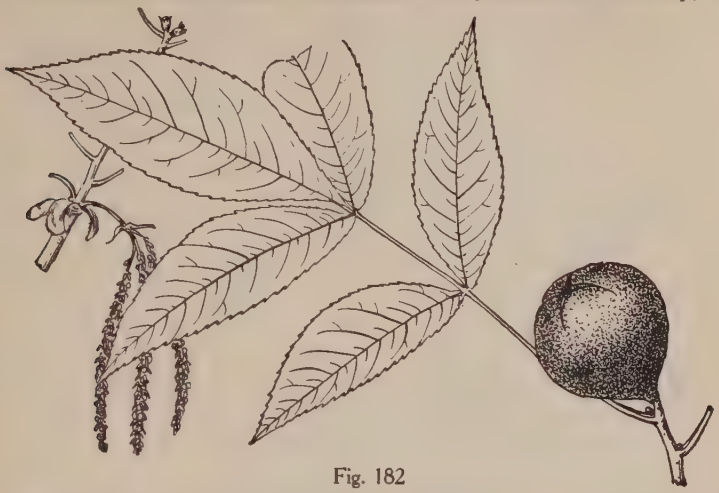

Fig. 182

of Columbia and southward to the shores of Indian River and the valley of the Caloosahatchee River, Florida, and through southern Alabama to western Louisiana; one of the commonest Hickories in the coast region of the south Atlantic and east Gulf states, occasionally ranging inland to central and northern Georgia and western Mississippi.

13. Carya ovalis Sarg.

Leaves 6′–10′ long, with slender petioles often scurfy-pubescent early in the season, soon glabrous, and 7 or rarely 5 lanceolate to oblanceolate, or occasionally obovate finely serrate leaflets, long-pointed and acuminate or rarely rounded at apex, cuneate and unsymmetrical at base, early in the season often scurfy-pubescent and furnished below with small axillary tufts of pale hairs, soon glabrous, the upper 6′ or 7′ long and $1\frac{1}{2}'$–2′ wide, and raised on a stalk $\frac{1}{4}'$–$\frac{1}{2}'$ in length, the lateral sessile, those of the upper pairs as large or slightly smaller than the terminal leaflet. **Flowers:** staminate in puberulous aments 6′–7′ long, pubescent, their bracts twice longer than the ovate acute calyx-lobes; stamens 4, anthers yellow, thickly covered with pale hairs; pistillate in 1 or 2-flowered spikes, obovoid, more or less thickly covered with yellow scales. **Fruit** ellipsoidal, acute or rounded at apex, rounded at base, puberulous, 1′–$1\frac{1}{4}'$ long, about $\frac{3}{4}'$ in diameter, with a husk $\frac{1}{12}'$–$\frac{1}{10}'$ in thickness, splitting freely to the base; **nut** pale, oblong, slightly flattened, rounded at base, acute or acuminate and 4-angled at apex, the ridges extending for one-third or rarely for one-half of its length, with a shell rarely more than $\frac{1}{5}'$ in thickness; **seed** small and sweet.

A tree sometimes 100° high, with a tall trunk occasionally 3° in diameter, small spreading branches forming a narrow often pyramidal head, and slender lustrous red-brown branchlets marked by pale lenticels, often slightly pubescent when they first appear, soon glabrous. **Winter-buds** ovoid, obtuse, acute or acuminate; the terminal often $\frac{1}{2}'$ long and twice as large as the lateral, the outer scales red-brown, lustrous and glabrous, the inner covered with close pale tomentum. **Bark** slightly ridged, pale gray, usually separating freely into small plate-like scales, or occasionally close. **Wood** heavy, hard and tough, flexible, light or dark brown, with thick lighter-colored sapwood; used for the handles of tools, in the manufacture of wagons and agricultural implements, and largely for fuel.

Distribution. Hillsides and rich woods; western New York, eastern Pennsylvania and the District of Columbia to southern Illinois and central Iowa (Ames, Story County), and

Fig. 183

southward to the mountains of North Carolina and Tennessee, and to central Georgia and Alabama; usually rare and local; most abundant and generally distributed in Indiana. With its varieties usually but incorrectly called " Pignut."

The following varieties differing in the shape of their fruit are distinguished:

Carya ovalis var. obcordata Sarg.

Carya microcarpa Darling. in part.
Hicoria microcarpa Britt. in part.

Fruit subglobose to short-oblong or slightly obovoid, 1′–1¼′ in diameter, with a husk ½′–⅛′ in thickness, splitting freely to the base or nearly to the base by often narrow-winged

Fig. 184

sutures; **nut** much compressed, slightly angled and often broadest above the middle, rounded and usually more or less obcordate at apex, narrowed and rounded at base.

Distribution. Southern New England to southern Wisconsin, southwestern Missouri, western North Carolina, central and eastern Georgia, eastern Mississippi and central Alabama; the common and most widely distributed northern variety of *Carya ovalis;* common in the mountain districts of central Alabama and West Feliciana Parish, Louisiana; varying to the f. *vestita* Sarg. with stouter branchlets covered during their first year with rusty tomentum and more or less pubescent in their second and third seasons, leaflets slightly pubescent below, and with more compressed nuts and puberulous winter-buds. A single tree near Davis Pond, Knox County, Indiana.

Carya ovalis var. odorata Sarg.

Carya microcarpa Darling. in part.
Hicoria microcarpa Britt. in part.
Hicoria glabra var. *odorata* Sarg. in part.

Fruit subglobose or slightly longer than broad, much flattened, $\frac{1}{2}'$–$\frac{3}{5}'$ in diameter, with a husk not more than $\frac{1}{24}'$ in thickness, splitting freely to the base by sutures sometimes fur-

Fig. 185

nished with narrow wings; **nut** compressed, rounded at apex, rounded or acute at base, slightly or not at all ridged, pale or nearly white, with a shell $\frac{1}{12}'$ or less in thickness.

Distribution. Southern New England, eastern Pennsylvania and the District of Columbia to western New York, and southeastern Ontario, and through Ohio and Indiana to southern Illinois, southeastern Missouri and Heber Springs, Arkansas; near Atlanta, Georgia, and Starkville, Oktibbeha County, Mississippi; less variable in the size and shape of the fruit than the other varieties of *C. ovalis.*

Carya ovalis var. obovalis Sarg.

Hicoria glabra Sarg. in part.

Fruit more or less obovoid, about 1′ long and $\frac{4}{5}'$ in diameter, with a husk $\frac{1}{12}'$–$\frac{1}{8}'$ thick, splitting freely to the base. (Fig. 186.)

Distribution. Southern New England to Missouri and northern Arkansas; on the mountains of North Carolina, on the coast of Georgia and in north central Alabama, and West Feliciana Parish, Louisiana. The common "Pignut" in the middle western states, varying to f. *acuta* Sarg. with nuts pointed at the ends and closer bark; only near Rochester, Monroe County, New York.

Other forms of *C. ovalis* are var. *hirsuta* Sarg. (*Hicoria glabra hirsuta* Ashe) with obovoid compressed fruit narrowed into a stipitate base, with a husk $\frac{1}{2}'$–$\frac{1}{3}'$ in thickness, scaly bark, pubescent winter-buds, leaves with pubescent petioles and leaflets pubescent on the lower surface; a common tree on the mountains of North Carolina up to altitudes of 2000° above the sea; and var. *borealis* Sarg. (*Hicoria borealis* Ashe) with pubescent branch-

Fig. 186

lets and winter-buds, leaves pubescent early in the season, ellipsoidal or ovoid flattened fruit with a husk $\frac{1}{8}'$–$\frac{1}{5}'$ in thickness, an ovoid nut ridged to the base, and scaly bark; only in southeastern Michigan.

14. Carya floridana Sarg.

Leaves 6′–8′ long, with slender petioles rusty pubescent when they first appear, soon glabrous, with 5 or rarely 7 lanceolate to oblanceolate leaflets long-pointed and acuminate at apex, unsymmetrical and rounded or cuneate at base, serrate with remote cartilaginous teeth, sessile or the terminal leaflet short-stalked, covered when they unfold with rufous

Fig. 187

pubescence, soon glabrous, at maturity thin, conspicuously reticulate-venulose, yellow-green above, often brownish below, the upper three $3\frac{1}{2}'$–$4'$ long, 1′–2′ wide, and about twice larger than those of the lowest pair. **Flowers:** staminate in long-stalked scurfy pubescent aments 1′–$1\frac{1}{2}'$ in length, produced at the base of branchlets of the year from the axils of

bud-scales, and often of leaves, scurfy pubescent, their bract ovate, acuminate, a third longer than the calyx-lobes; stamens 4 or 5, anthers yellow, slightly villose near the apex; pistillate in 1 or 2-flowered spikes, obovoid, thickly covered, like their bracts, with yellow scales. **Fruit** obovoid, gradually narrowed, rounded and sometimes slightly depressed at apex, narrowed below into a short stipe-like base, occasionally slightly winged at the sutures, often roughened by prominent reticulate ridges, puberulous and covered with small yellow scales, $\frac{4}{5}'$–$1\frac{1}{2}'$ long, $\frac{3}{4}'$–$1'$ in diameter with a husk $\frac{1}{12}'$–$\frac{1}{8}'$ thick, splitting freely to the base by 2 or 3 sutures; **nut** pale or reddish, subglobose, not more than $\frac{3}{5}'$ in diameter, or ovoid or rarely oblong, acute at base, narrowed and rounded at apex, slightly compressed, with a shell $\frac{1}{12}'$–$\frac{1}{6}'$ in thickness.

A tree 50°–70° high with a trunk up to 20′ in diameter, slender spreading branches forming a broad head, and slender branchlets at first coated with rufous pubescence, soon puberulous or glabrous, bright red-brown and marked by pale lenticels during their first winter; or in dry sand often a shrub producing abundant fruit on stems 3° or 4° high. **Winter-buds** ovoid, acute or obtuse, the outer scales covered with thick rusty pubescence and more or less thickly with yellow or rarely silvery scales, the inner coated with pale pubescence; the terminal $\frac{1}{5}'$–$\frac{1}{3}'$ in length and twice as large as the axillary buds. **Bark** slightly ridged, close dark gray-brown. **Wood** dark brown, with pale sapwood; probably used only for fuel.

Distribution. Dry sandy ridges and low hills, Florida; east coast, Volusia County to Jupiter Island, Palm Beach County; in the interior of the peninsula as a shrub, from Orange to De Soto Counties, and on the shores of Pensacola Bay.

15. Carya Buckleyi Durand.

Carya texana Buckl., not *Le Conte*

Leaves 8′–12′ long, with slender petioles rusty pubescent and sparingly villose early in the season, and 5–7, usually 7, lanceolate to oblanceolate acuminate bluntly serrate sessile

Fig. 188

leaflets, the terminal occasionally broadly obovate and abruptly pointed, and sometimes raised on a winged stalk $\frac{1}{4}'$–$\frac{1}{2}'$ in length, when they unfold thickly covered with rusty pubescence mixed with small white scales and villose on the lower side of the midrib and veins,

and at maturity dark green, lustrous, glabrous or puberulous along the midrib above, paler, glabrous or sparingly villose and furnished with small tufts of axillary hairs below, the upper three leaflets 4′–6′ long and 2′–2¼′ wide, and twice the size of those of the lowest pair. **Flowers:** staminate in rusty pubescent aments 2′–3′ long, their bract slender, long acuminate, 3 or 4 times longer than the acuminate calyx-lobes; stamens 4 or 5, anthers yellow, slightly villose toward the apex; pistillate in 1 or 2-flowered short-stalked spikes, slightly angled, thickly coated with rufous hairs like the bract and bractlets. **Fruit** subglobose, puberulous, 1¼′–1¾′ in diameter, with a husk ½′–⅛′ thick, splitting freely to the base by slightly winged sutures; **nut** slightly compressed, rounded at base, abruptly narrowed and acute at apex, 4-angled above the middle or nearly to the base, dark reddish brown, conspicuously reticulate-venulose with pale veins, with a shell about ⅛′ thick; in drying often cracking longitudinally between the angles; **seed** small and sweet.

A tree, usually 30°–45° or rarely 60° high, with a trunk 12′–24′ in diameter, large spreading often drooping more or less contorted branches forming a narrow head, and slender light red-brown branchlets marked by pale lenticels, more or less densely rusty pubescent during their first season and dark gray-brown and glabrous or nearly glabrous the following year. **Winter-buds** ovoid, covered with rusty pubescence mixed with silvery scales, furnished at apex with long pale hairs; the terminal bud abruptly contracted and long-pointed at apex, ⅖′–½′ in length and ¼′–⅓′ in diameter, and 2 or 3 times larger than the flattened acute lateral buds. **Bark** thick, deeply furrowed, rough, dark often nearly black. **Wood** hard, brittle, little used except for fuel.

Distribution. Dry sandy uplands with Post and Black Jack Oaks; northern and eastern Texas (Grayson, Cherokee, San Augustine and Atascosa Counties), and in central Oklahoma (dry sand hills, Muskogee County).

Carya Buckleyi var. arkansana Sarg.

Carya arkansana Sarg.

Differing from *Carya Buckleyi* in the shape of the fruit and sometimes in the bark of the trunk. **Fruit** obovoid, rounded at apex, rounded or gradually narrowed or abruptly con-

Fig. 189

tracted into a more or less developed stipe at base, or ellipsoidal, or ovoid and rounded at the ends, ⅘′–1½′ in length and in diameter, with a husk ½′–⅛′ thick, splitting to the middle or nearly to the base by slightly winged sutures; **nut** oblong to slightly obovoid, rounded at

the ends, compressed, slightly 4-angled occasionally to the middle, pale brown, with a shell $\frac{1}{8}'$–$\frac{1}{5}'$ in thickness; seed small and sweet.

A tree from 60°–75° high, with a trunk 2° in diameter; southward usually much smaller. Bark on some trees dark gray, irregularly fissured, separating into thin scales, and on others close, nearly black and deeply divided into rough ridges.

Distribution. Dry hillsides, rocky ridges, or southward on sandy upland; southwestern Indiana (Knox County), southern Illinois, northeastern Missouri and southward through Missouri and Arkansas to eastern Oklahoma, western Louisiana and northern and eastern Texas to the valley of the Atascosa River, Atascosa County; the common Hickory of the Ozark Mountain region, Arkansas, and here abundant on dry rocky ridges at altitudes of 1200°–1800°; in Texas the common Hickory from the coast to the base of the Edwards Plateau; trees with the smallest fruit northward; those with the largest fruit with thickest husks in Louisiana, and in southern Arkansas (f. *pachylemma* Sarg.), a tree with slender nearly glabrous branchlets, deeply fissured pale gray bark, rusty pubescent winter-buds and fruit $2\frac{1}{2}'$ long and $2'$ in diameter, with a husk $\frac{1}{2}'$ in thickness.

Carya Buckleyi var. villosa Sarg.

Hicoria glabra var. *villosa* Sarg.
Hicoria villosa Ashe.
Carya villosa Schn.
Carya glabra var. *villosa* Robins.

Leaves 6′–10′ long, with slender petioles and rachis pubescent with fascicled hairs early in the season, generally becoming glabrous, and 5–7, usually 7, lanceolate to oblanceolate finely serrate leaflets long-pointed and acuminate at apex, cuneate or rounded and often unsymmetrical at base, sessile or the terminal leaflet sometimes short-stalked, dark green and gla-

Fig. 190

brous above, pale and pubescent below, the lower side of the midrib often covered with fascicled hairs, the upper leaflets 3′–4′ long and $1'$–$1\frac{1}{2}'$ wide, and twice as long as those of the lowest pair. Flowers: staminate in aments pubescent with fascicled hairs, 4′–8′ long, pubescent, their bract acuminate, not much longer than the rounded calyx-lobes; pistillate in 1 or 2-flowered spikes, rusty pubescent, slightly angled. Fruit obovoid to ellipsoidal, rounded at apex, cuneate and often abruptly narrowed into a stipitate base, rusty pubescent and covered with scattered yellow scales, about 1′ long and $\frac{3}{4}'$ in diameter, with a husk $\frac{1}{12}'$ in thickness, splitting tardily to the base by 1 or 2 sutures or indehiscent; nut ovoid, rounded

at base, pointed at apex, only slightly angled, faintly tinged with red, with a shell rarely more than $\frac{1}{12}'$ in thickness; seed small and sweet.

A tree 30°–40° high, with a trunk 12′–18′ in diameter, stout often contorted branches and slender branchlets covered at first with rusty pubescence mixed with fascicled hairs and pubescent or glabrous during their first winter. Winter-buds ovoid, acute, covered with rusty pubescence mixed with yellow scales, often furnished near the apex with tufts of white hairs, the terminal $\frac{1}{4}'$ long and about twice as large as the compressed axillary buds.

Distribution. Dry rocky hills, Allenton, Saint Louis County, Missouri, to southern Illinois, northern Arkansas, and northeastern Oklahoma. Distinct from other forms of *Carya Buckleyi* in the often indehiscent fruit and more numerous and longer fascicled hairs, and possibly better considered a species.

IX. BETULACEÆ.

Trees, with sweet watery juice, without terminal buds, their slender terete branchlets marked by numerous pale lenticels and lengthening by one of the upper axillary buds formed in early summer, and alternate simple penniveined usually doubly serrate deciduous stalked leaves, obliquely plicately folded along the primary veins, their petioles in falling leaving small semioval slightly oblique scars showing three equidistant fibro-vascular bundle-scars; stipules inclosing the leaf in the bud, fugacious. Flowers vernal, appearing with or before the unfolding of the leaves, or rarely autumnal, monœcious, the staminate 1–3 together in the axils of the scales of an elongated pendulous lateral ament and composed of a 2–4-parted membranaceous calyx and 2–20 stamens inserted on a receptacle, with distinct filaments and 2-celled erect extrorse anthers opening longitudinally, or without a calyx, the pistillate in short lateral or capitate aments, with or without a calyx, a 2-celled ovary, narrowed into a short style divided into two elongated branches longer than the scales of the ament and stigmatic on the inner face or at the apex, and a single anatropous pendulous ovule in each cell of the ovary. Fruit a small mostly 1-celled 1-seeded nut, the outer layer of the shell light brown, thin and membranaceous, the inner thick, hard, and bony. Seed solitary by abortion, filling the cavity of the nut, suspended, without albumen, its coat membranaceous, light chestnut-brown; cotyledons thick and fleshy, much longer than the short superior radicle turned toward the minute hilum.

Of the six genera, all confined to the northern hemisphere, five are found in North America; of these only Corylus is shrubby.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT GENERA.

Scales of the pistillate ament deciduous; nut wingless, more or less inclosed in an involucre formed by the enlargement of the bract and bractlets of the flower; staminate flowers solitary in the axils of the scales of the ament; caylx 0; pistillate flowers with a calyx.

Staminate aments covered during the winter: involucre of the fruit flat, 3-cleft, foliaceous. **1. Carpinus.**

Staminate aments naked during the winter: involucre of the fruit bladder-like, closed. **2. Ostrya.**

Scales of the pistillate ament persistent and forming a woody strobile; nut without an involucre, more or less broadly winged; staminate flowers 3–6 together in the axils of the scales of the ament; calyx present; pistillate flowers without a calyx.

Pistillate aments solitary, their scales 3-lobed, becoming thin, brown, and woody, deciduous; stamens 2; filaments 2-branched, each division bearing a half-anther; winter-buds covered by imbricated scales. **3. Betula.**

Pistillate aments racemose, their scales erose or 5-toothed, becoming thick, woody, and dark-colored, persistent; stamens 1–3 or 4; filaments simple; wings of the nut often reduced to a narrow border; winter-buds without scales. **4. Alnus.**

1. CARPINUS L. Hornbeam.

Trees, with smooth close bark, hard strong close-grained wood, elongated conic buds covered by numerous imbricated scales, the inner lengthening after the opening of the buds. Leaves open and concave in the bud, ovate, acute, often cordate; stipules strap-shaped to oblong-obovate. Flowers: staminate in aments emerging in very early spring from buds produced the previous season near the ends of short lateral branchlets of the year and inclosed during the winter, composed of 3–20 stamens crowded on a pilose receptacle adnate to the base of a nearly sessile ovate acute coriaceous scale longer than the stamens; filaments short, slender, 2-branched, each branch bearing a 1-celled oblong yellow half-anther hairy at the apex; pistillate in lax semi-erect aments terminal on leafy branches of the year, in pairs at the base of an ovate acute leafy deciduous scale, each flower subtended by a small acute bract with two minute bractlets at its base; calyx adnate to the ovary and dentate on the free narrow border. Nut ovoid, acute, compressed, conspicuously longitudinally ribbed, bearing at the apex the remnants of the calyx, marked on the broad base by a large pale scar and separating at maturity in the autumn from the leaf-like 3-lobed conspicuously serrate green involucre formed by the enlargement of the bract and bractlets of the flower and inclosing only the base of the nut, fully grown at mid-summer and loosely imbricated into a long-stalked open cluster. (*Eucarpinus.*)

Carpinus is confined to the northern hemisphere, and is distributed from the Province of Quebec through the eastern United States to the highlands of Central America in the New World, and from Sweden to southern Europe, Asia Minor, the temperate Himalayas, Korea, southern China, Japan and Formosa in the Old World. Fifteen or sixteen species are recognized. Of the exotic species, the European and west Asian *Carpinus Betulus* L. is frequently planted as an ornamental tree in the northeastern United States, where some of the species of eastern Asia promise to become valuable.

Carpinus is the classical name of the Hornbeam.

1. Carpinus caroliniana Walt. Hornbeam. Blue Beech.

Leaves often somewhat falcate, long-pointed, sharply doubly serrate with stout spreading glandular teeth, except at the rounded or wedge-shaped often unequal base, pale

Fig. 191

bronze-green, and covered with long white hairs when they unfold, at maturity thin and firm, pale dull blue-green above, light yellow-green and glabrous or puberulous below, with small tufts of white hairs in the axils of the veins, 2′–4′ long, 1′–1¾′ wide, with a slender yellow midrib, numerous slender veins deeply impressed and conspicuous above, and prominent cross veinlets; turning deep scarlet and orange color late in the autumn;

petioles slender, terete, hairy, about $\frac{1}{3}'$ long, bright red while young; stipules ovate-lanceolate, acute, pubescent, hairy on the margins, bright red below, light yellow-green at the apex, $\frac{1}{3}'$ long. **Flowers:** staminate aments $1\frac{1}{2}'$ long when fully grown, with broadly ovate acute boat-shaped scales green below the middle, bright red above; pistillate aments $\frac{1}{2}'$–$\frac{3}{4}'$ long, with ovate acute hairy green scales; styles scarlet. **Fruit:** nut $\frac{1}{3}'$ long, its involucre short-stalked, with one of the lateral lobes often wanting, coarsely serrate, but usually on one margin only of the middle lobe, $1'$–$1\frac{1}{2}'$ long, nearly $1'$ wide, crowded on slender terete pubescent red-brown stems $5'$–$6'$ in length.

A bushy tree, rarely 40° high, with a short fluted trunk occasionally 2° in diameter, long slightly zigzag slender tough spreading branches pendulous toward the ends, and furnished with numerous short thin lateral branches growing at acute angles, and branchlets at first pale green coated with long white silky hairs, orange-brown and sometimes slightly pilose during the summer, becoming dark red and lustrous during their first winter and ultimately dull gray tinged with red. **Winter-buds** ovoid, acute, about $\frac{1}{8}'$ long, with ovate acute chestnut-brown scales white and scarious on the margins. **Bark** light gray-brown, sometimes marked with broad dark brown horizontal bands, $\frac{1}{16}'$–$\frac{1}{8}'$ thick. **Wood** light brown, with thick nearly white sapwood; sometimes used for levers, the handles of tools, and other small articles.

Distribution. Borders of streams and swamps, generally in deep rich moist soil; Nova Scotia and southern and western Quebec to the northern shores of Georgian Bay, southward nearly to the shores of Indian River and those of Tampa Bay, Florida, and westward to central Minnesota, eastern Iowa, eastern Nebraska (reported), eastern and southern Missouri, eastern Oklahoma, and eastern Texas; reappearing on the mountains of southern Mexico and Central America; common in the eastern and central states; most abundant and of its largest size on the western slopes of the southern Alleghany Mountains and in southern Arkansas and eastern Texas.

2. OSTRYA Scop. Hop Hornbeam.

Trees, with scaly bark, heavy hard strong close-grained wood, and acute elongated winter-buds formed in early summer and covered by numerous imbricated scales, the inner lengthening after the opening of the bud. Leaves open and concave in the bud; petioles slender, nearly terete, hairy; stipules strap-shaped to oblong-obovate. Flowers: staminate in long clustered sessile or short-stalked aments developed in early summer from lateral buds near the ends of short lateral branchlets of the year and coated while young with hoary tomentum, naked and conspicuous during the winter, and composed of 3–14 stamens crowded on a pilose receptacle adnate to the base of an ovate concave scale rounded and abruptly short-pointed at the apex, ciliate on the margins, longer than the stamens; filaments short, 2-branched, each branch bearing a 1-celled half-anther hairy at the apex; pistillate in erect lax aments terminal on short leafy branches of the year, in pairs at the base of an elongated ovate acute leaf-like ciliate scale persistent until midsummer, each flower inclosed in a hairy sack-like involucre formed by the union of a bract and 2 bractlets; calyx adnate to the ovary, denticulate on the free narrow border. Nut ovoid, acute, flattened, obscurely longitudinally ribbed, crowned with the remnants of the calyx, marked at the narrow base by a small circular pale scar, inclosed in the much enlarged pale membranaceous conspicuously longitudinally veined reticulate-venulose involucres of the flower, short, pointed and hairy at the apex, hirsute at the base, with sharp rigid stinging hairs, imbricated into a short strobile fully grown at midsummer, and suspended on a slender hairy stem.

Ostrya is widely distributed in the northern hemisphere from Nova Scotia to Texas, northern Arizona, and to the highlands of southern Mexico and Guatemala in the New World, and through southern Europe and southwestern Asia, and in northern Japan and on the Island of Quelpart in the Old World. Of the four species now recognized two are North American.

Ostrya is the classical name of the Hop Hornbeam.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Leaves oblong-lanceolate, acuminate or acute at apex. 1. **O. virginiana** (A, C).
Leaves elliptic or obovate, acute or rounded at apex. 2. **O. Knowltonii** (F).

1. Ostrya virginiana K. Koch. Hop Hornbeam. Ironwood.

Leaves oblong-lanceolate, gradually narrowed into a long slender point or acute at apex, narrowed and rounded, cordate, or wedge-shaped at the often unequal base, sharply serrate, with slender incurved callous teeth terminating at first in tufts of caducous hairs, when they unfold light bronze-green, glabrous above and coated below on the midrib and primary veins with long pale hairs, at maturity thin and extremely tough, dark dull yellow-green above, light yellow-green and furnished with conspicuous tufts of pale hairs in the axils of the veins below, 3′–5′ long, 1½′–2′ wide, with a slender midrib impressed and puberulous above, light yellow and pubescent below, and numerous slender veins forked near the margins; turning clear yellow before falling in the autumn; petioles hairy about ¼′ long; stipules rounded and often short-pointed at apex, ciliate on the margins with long pale hairs, hairy on the back, about ½′ long and ⅛′ wide. **Flowers:** staminate aments about ½′ long during their first season, with light red-brown rather loosely imbricated scales nar-

Fig. 192

rowed into a long slender point, becoming when the flowers open 2′ long, with broadly obovate scales rounded and abruptly contracted at apex into a short point, ciliate on the margins, green tinged with red above the middle, light brown toward the base; pistillate aments slender, about ¼′ long, on thin hairy stems, their scales lanceolate, acute, light green, often flushed with red above the middle, hirsute at the apex, decreasing in size from the lowest. **Fruit:** nuts ⅓′ long, about ⅛′ wide, rather abruptly narrowed below the apex, their involucres in clusters 1½′–2′ long and ⅔′–1′ wide, on slender hairy stems about 1′ in length.

A tree, occasionally 50°–60° high, with a short trunk 2° in diameter, usually not more than 20°–30° tall, with a trunk 18′–20′ thick, long slender branches drooping at the ends and forming a round-topped or open head frequently 50° across, and slender, very tough branchlets, light green, coated with pale appressed hairs when they first appear, becoming light orange color and very lustrous by midsummer, glabrous, dark red-brown and lustrous during their first winter, and then growing gradually darker brown and losing their lustre; or covered like the petioles and peduncles with short erect glandular hairs (var. *glandulosa* Sarg.).

Winter-buds ovoid, light chestnut-brown, slightly puberulous, $\frac{1}{4}'$ long. **Bark** about $\frac{1}{4}'$ thick, broken into thick narrow oblong closely appressed plate-like light brown scales slightly tinged with red on the surface. **Wood** strong, hard, tough, durable, light brown tinged with red or often nearly white, with thick pale sapwood of 40–50 layers of annual growth; used for fence-posts, handles of tools, mallets, and other small articles.

Distribution. Dry gravelly slopes and ridges often in the shade of oaks and other large trees; Island of Cape Breton and the shores of the Bay of Chaleur, through the valley of the St. Lawrence River, and along the northern shores of Lake Huron to western Ontario, Manitoba, Minnesota, eastern North Dakota, the foothills of the Black Hills of South Dakota, eastern, northern and northwestern Nebraska, eastern Kansas and Oklahoma, and southward to central Florida and eastern Texas; most abundant and of its largest size in southern Arkansas and in Texas. From Quebec and Ontario to western New England, western New York, Ohio and in Central Michigan, the glandular form prevails: the two forms occur in New Jersey, Pennsylvania, Indiana, northern Illinois, southwestern Missouri, Oklahoma, and southward on the high Appalachian Mountains.

2. Ostrya Knowltonii Cov. Ironwood.

Leaves elliptic to obovate, acute or round at apex, gradually narrowed and often unequal at the rounded cuneate rarely cordate base, sharply serrate with small triangular callous teeth, covered with loose pale tomentum when they unfold, at maturity dark yellow-green and pilose above, pale and soft-pubescent below, $1'$–$2'$ long, $1'$–$1\frac{1}{2}'$ wide, with a slender yellow midrib slightly raised on the upper side, and slender primary veins connected by obscure reticulate veinlets; turning dull yellow in the autumn before falling; petioles $\frac{1}{8}'$–$\frac{1}{4}'$ long; stipules pale yellow-green, often tinged with red toward the apex, $\frac{1}{2}'$ long, about $\frac{1}{2}'$ wide. **Flowers:** staminate aments on stout stalks covered with rufous tomentum and sometimes $\frac{1}{2}'$ long, rarely sessile, about $\frac{1}{2}'$ long during their first season, with

Fig. 193

dark brown puberulous scales gradually contracted into a long slender subulate point, becoming when the flowers open $1'$–$1\frac{1}{4}'$ long, with broadly ovate concave scales abruptly narrowed into a nearly triangular point, yellow-green near the base, bright red above the middle; pistillate aments about $\frac{1}{4}'$ long, with ovate-lanceolate light yellow-green puberulous scales ciliate on the margins. **Fruit:** nuts $\frac{1}{4}'$ long, gradually narrowed at the apex, their involucres $1'$ long, nearly glabrous at the apex, sometimes slightly stained with red toward the base, in clusters $1'$–$1\frac{1}{2}'$ long and about $\frac{3}{4}'$ broad, on stems $\frac{1}{2}'$ in length.

A tree 20°–30° high, with a trunk 12′–18′ in diameter, usually divided 1° or 2° above the ground into 3 or 4 stout upright stems 4′–5′ thick, slender pendulous often much contorted branches forming a narrow round-topped symmetrical head, and slender branchlets dark green and coated with hoary tomentum when they first appear, dark red-brown and pubescent during their first summer, becoming light cinnamon-brown, glabrous, and lustrous in the winter, and ultimately ashy gray. **Winter-buds** ovoid, dark brownish red, about $\frac{1}{8}$′ long. **Bark** internally bright orange color, $\frac{1}{8}$′ thick, separating into loose hanging plate-like scales light gray slightly tinged with red, and 1′–2′ long and wide. **Wood** light reddish brown, with thin sapwood.

Distribution. On the southern slope of the cañon of the Colorado River in Coconino County, Arizona, at altitudes of 6000°–7000° above the sea (Hance trail, seventy miles north of Flagstaff); in the cañon of Oak Creek, south of Flagstaff (*P. Lowell*); and on Grand River, Utah (Moab, Grant County, *M. E. Jones*).

3. BETULA L. Birch.

Trees, with smooth resinous bark marked by long longitudinal lenticels, often separating freely into thin papery plates, becoming thick, deeply furrowed, and scaly at the base of old trunks, short slender branches more or less erect and forming on young trees a narrow symmetrical pyramidal head, becoming horizontal and often pendulous on older trees, tough branchlets, short stout spur-like 2-leaved lateral branchlets much roughened by the crowded leaf-scars of many years, and elongated winter-buds covered by numerous ovate acute scales, and fully grown and bright green at midsummer. Leaves open and convex in the bud, often incisely lobed; stipules ovate and acute or oblong-obovate, scarious. Flowers in 3-flowered cymes, the lateral flowers of the cyme subtended by bractlets adnate to the base of the scale of the ament; staminate aments long, pendulous, solitary or clustered, appearing in summer or autumn in the axils of the last leaves of a branchlet or near the ends of short lateral branchlets, erect and naked during the winter, their scales in the spring broadly ovate, rounded, short-stalked, yellow or orange-color below the middle and dark chestnut-brown and lustrous above it: staminate flowers composed of a membranaceous 4-lobed calyx often 2-lobed by suppression, the anterior lobe obovate, rounded at apex, as long as the stamens, much longer than the minute posterior lobe, and of 2 stamens inserted on the base of the calyx, with short 2-branched filaments, each branch bearing an erect half-anther; pistillate aments oblong or cylindric, terminal on the short spur-like lateral branchlets, their scales closely imbricated, oblong-ovate, 3-lobed, light yellow, often tinged with red above the middle, accrescent, becoming brown and woody at maturity, and forming sessile or stalked erect or pendulous short or elongated strobiles usually ripening in the autumn, deciduous with the nuts from the slender rachis; calyx of the pistillate flower 0; ovary sessile, compressed, with styles stigmatic at apex. Nut minute, oval or obovoid, compressed, bearing at the apex the persistent stigmas, marked at the base by a small pale scar, the outer coat of the shell produced into a marginal wing interrupted at the apex.

Betula is widely distributed from the Arctic circle to Texas in the New World, and to southern Europe, the Himalayas, China, and Japan in the Old World, some species forming great forests at the north, or covering high mountain slopes. Of the twenty-eight or thirty species now recognized twelve are found in North America; of these nine are trees. Of exotic species the European and Asiatic *Betula pendula* Roth. in a number of forms is a common ornamental tree in the northern states, where several of the Birch-trees of eastern Asia also flourish. Many of the species produce wood valued by the cabinet-maker, or used in the manufacture of spools, shoe-lasts, and other small articles. The thin layers of the bark are impervious to water and are used to cover buildings, and for shoes, canoes, and boxes. The sweet sap provides an agreeable beverage.

Betula is the classical name of the Birch-tree.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT SPECIES.

Strobiles oblong-ovoid, nearly sessile, erect, the lateral lobes of their scales broad and slightly divergent; wing not broader than the nut; leaves with 9–11 pairs of veins; bark of young branches aromatic.

Leaves heart-shaped or rounded at base; scales of the strobiles glabrous; bark dark brown, not separating into thin layers. **1. B. lenta** (A, C).

Leaves cuneate or slightly heart-shaped at base; scales of the strobiles pubescent; bark yellow, or silvery white, rarely dull yellowish brown; separating into thin layers. **2. B. lutea** (A).

Strobiles oblong or cylindric, erect, spreading or pendant, on slender peduncles; wing broader than the nut; leaves with 5–9 pairs of veins.

Strobiles oblong, erect, ripening in May or June, their scales pubescent, deeply lobed, the lateral lobes erect; leaves rhombic-ovate, glaucescent and more or less silky-pubescent beneath; bark light reddish-brown, separating freely into thin persistent scales. **3. B. nigra** (A, C).

Strobiles cylindric, pendant or spreading.

Scales of the strobiles pubescent, with recurved lateral lobes, the middle lobe triangular, nearly as broad as long; leaves long-pointed; petioles slender, elongated.

Leaves triangular to rhombic, bright green and lustrous; bark chalky white, not separable into thin layers. **4. B. populifolia** (A).

Leaves ovate, cuneate to truncate or rounded at base, dull blue-green; bark white tinged with pink, lustrous, not easily separable into thin layers. **5. B. cœrulea** (A).

Scales of the strobiles with ascending or spreading lateral lobes, the middle lobe usually acuminate, longer than broad; leaves acute or acuminate.

Bark separating freely into thin layers; scales of the strobiles glabrous.

Bark creamy white, or in some forms orange-brown; leaves ovate. **6. B. papyrifera** (A, B, C, F).

Bark dull reddish brown or nearly white; leaves rhombic to deltoid-ovate. **7. B. alaskana** (A, B).

Bark not separable into thin layers, dark brown; scales of the strobiles glabrous or puberulous; branchlets glandular.

Leaves ovate, acute or acuminate, truncate or rounded at the broad base. **8. B. fontinalis** (B, F, G).

Leaves broad-ovate to elliptic, acute, rounded or abruptly short-pointed, cuneate at base. **9. B. Eastwoodæ** (F).

1. Betula lenta L. Cherry Birch. Black Birch.

Betula alleghaniensis Britt.

Leaves ovate to oblong-ovate, acute or acuminate, gradually narrowed and often unequal at the cordate or rounded base, sharply serrate with slender incurved teeth, or very rarely laciniately lobed (f. *laciniata* Rehdr.), when they unfold light green, coated on the lower surface with long white silky hairs, and slightly hairy on the upper surface, at maturity thin and membranaceous, dark dull green above, light yellow-green below, with small tufts of white hairs in the axils of the veins, $2\frac{1}{2}'$–$6'$ long, $1\frac{1}{2}'$–$3'$ wide, with a yellow midrib and primary veins prominent and hairy on the lower surface, and obscure reticulate cross veinlets; turning bright clear yellow late in the autumn; petioles stout, hairy, deeply grooved on the upper side, $\frac{3}{4}'$–$1'$ long; stipules ovate, acute, light green or nearly white, scarious and ciliate above the middle. **Flowers:** staminate aments during the winter about $\frac{3}{4}'$ long, nearly $\frac{1}{4}'$ thick, with ovate acute apiculate scales bright red-brown above the middle and light brown below it, becoming $3'$–$4'$ long; pistillate aments $\frac{1}{2}'$–$\frac{3}{4}'$ long, about $\frac{1}{8}'$ thick, with ovate pale green scales rounded at the apex; styles light pink. **Fruit:** strobiles oblong-ovoid, sessile, erect, glabrous, $1'$–$1\frac{1}{2}'$ long, about $\frac{1}{2}'$ thick; nut obovoid, pointed at base, rounded at apex, about as broad as its wing.

A tree, with aromatic bark and leaves, 70°–80° high, with a trunk 2°–5° in diameter, slender branches spreading almost at right angles, becoming pendulous toward the ends and gradually forming a narrow round-topped open graceful head, and branchlets light green, slightly viscid and pilose when they first appear, soon turning dark orange-brown, lustrous during the summer, bright red-brown in their first winter, becoming darker and finally dark dull brown slightly tinged with red. **Winter-buds** ovoid, acute, about $\frac{1}{4}'$ long, with ovate acute light chestnut-brown loosely imbricated scales, those of the inner ranks becoming $\frac{1}{2}'$–$\frac{3}{4}'$ long. **Bark** on young stems and branches close, smooth, lustrous, dark brown tinged with red, and marked by elongated horizontal pale lenticels, becoming on old trunks $\frac{1}{2}'$–$\frac{3}{4}'$ thick, dull, deeply furrowed and broken into large thick irregular plates

Fig. 194

covered with closely appressed scales. **Wood** heavy, very strong and hard, close-grained, dark brown tinged with red, with thin light brown or yellow sapwood of 70–80 layers of annual growth; largely used for floors, in the manufacture of furniture and for fuel, and occasionally in ship and boatbuilding. Sweet birch-oil distilled from the wood and bark is used for medicinal purposes and for flavoring as a substitute for oil of wintergreen, and beer is obtained by fermenting the sugary sap.

Distribution. Rich uplands from southern Maine to northwestern Vermont, and eastern Ohio and southward to northern Delaware and along the Appalachian Mountains up to altitudes of 4000° to northern Georgia; in Alabama, and in eastern Kentucky and Tennessee; a common forest tree at the north, and of its largest size on the western slopes of the southern Alleghany Mountains.

× *Betula Jackii* Schn., a natural hybrid of *B. lenta* with *B. pumila* Michx., has appeared in the Arnold Arboretum.

2. Betula lutea Michx. Yellow Birch. Gray Birch.

Leaves ovate to oblong-ovate, acuminate or acute at apex, gradually narrowed to the rounded cuneate or rarely heart-shaped usually oblique base, sharply doubly serrate, when they unfold bronze-green or red, and pilose with long pale hairs above and on the under side of the midrib and veins, at maturity dull dark green above, yellow-green below, 3′–4½′ long, 1½′–2′ wide, with a stout midrib and primary veins covered below near the base of the leaf with short pale or rufous hairs; turning clear bright yellow in the autumn; petioles slender, pale yellow, hairy, $\frac{3}{4}'$–1′ long; stipules ovate, acute, light green tinged with pink above the middle, about $\frac{1}{2}'$ long. **Flowers:** staminate aments during the winter $\frac{3}{4}'$–1′ long, about $\frac{1}{8}'$ thick, with ovate rounded scales light chestnut-brown and lustrous above the middle, ciliate on the margins, becoming 3′–3½′ long and $\frac{1}{3}'$ thick; pistillate aments

about $\frac{2}{3}'$ long, with acute scales, pale green below, light red and tipped with clusters of long white hair at apex, and pilose on the back. **Fruit:** strobiles erect, sessile, short-stalked, pubescent, $1'$–$1\frac{1}{2}'$ long, about $\frac{3}{4}'$ thick; nut ellipsoidal to obovoid, about $\frac{1}{8}'$ long, rather broader than its wing.

A tree, with slightly aromatic bark and leaves, occasionally 100° high, with a trunk 3°–4° in diameter, spreading and more or less pendulous branches forming a broad round-topped head, and branchlets at first green and covered with long pale hairs, light orange-brown and pilose during their first summer, becoming glabrous and light brown slightly tinged with orange, and ultimately dull and darker. **Winter-buds** about $\frac{1}{4}'$ long, somewhat viscid and covered with loose pale hairs during the summer, becoming light chestnut-brown, acute, and slightly puberulous in winter. **Bark** of young stems and of the branches bright silvery gray or light orange color, very lustrous, separating into thin loose persistent scales more or less rolled on the margins, becoming on old trees $\frac{1}{2}'$ thick, reddish

Fig. 195

brown, and divided by narrow irregular fissures into large thin plates covered with minute closely appressed scales, or sometimes dull yellowish brown (*B. alleghaniensis* Britt.). **Wood** heavy, very strong, hard, close-grained, light brown tinged with red, with thin nearly white sapwood; largely used for floors, in the manufacture of furniture, button and tassel moulds, boxes, the hubs of wheels, and for fuel.

Distribution. Moist uplands, and southward often in swamps; one of the largest deciduous-leaved trees of northeastern America; Newfoundland and along the northern shores of the Gulf of St. Lawrence to the valley of Rainy River, and southward to Long Island (Cold Spring Harbor) and western New York, Pennsylvania, northern Delaware, southeastern Ohio, northern Indiana, southwestern Wisconsin, northern, northeastern and central Iowa, and from the mountains of Virginia and West Virginia to the highest peaks of North Carolina and Tennessee at altitudes between 3000° and 5000°; very abundant and of its largest size in the eastern provinces of Canada and in northern New York and New England; small and rare in southern New England and southward.

× *Betula Purpusii* Schn. believed to be a natural hybrid of *B. lutea* with *B. pumila* var. *glandulifera* Regel has been found in Michigan and in Tamarack Swamps in Hennepin, Pine and Anoka Counties, Minnesota.

3. Betula nigra L. Red Birch. River Birch.

Leaves rhombic-ovate, acute, abruptly or gradually narrowed and cuneate at base, doubly serrate, and on vigorous young branches often more or less laciniately cut into acute

doubly serrate lobes, when they unfold light yellow-green and pilose above and coated below, especially on the midrib and petioles, with thick white tomentum, at maturity thin and tough, 1½′–3′ long, 1′–2′ wide, deep green and lustrous above, glabrescent, pubescent or ultimately glabrous below, except on the stout midrib and remote primary veins; turning dull yellow in the autumn; petioles slender, slightly flattened, tomentose, about ½′ long; stipules ovate, rounded or acute at apex, pale green, covered below with white hairs. **Flowers:** staminate aments clustered, during the winter about ⅞′ long and $\frac{1}{16}$ thick, with ovate rounded dull chestnut-brown lustrous scales, becoming 2′–3′ long and ⅛′ thick; pistillate aments about ⅓′ long, with bright green ovate scales pubescent on the back, rounded or acute at apex, and ciliate with long white hairs. **Fruit** ripening in May and June; strobiles cylindric, pubescent, 1′–1½′ long, ½′ thick, erect on stout tomentose peduncles ½′ long; nut ovoid to ellipsoidal, ⅛′ in length, pubescent or puberulous at apex, about as broad as its thin puberulous wing, ciliate on the margin.

Fig. 196

A tree, 80°–90° high, with a trunk often divided 15°–20° above the ground into 2 or 3 slightly diverging limbs, and sometimes 5° in diameter, slender branches forming in old age a narrow irregular picturesque crown, and branchlets coated at first with thick pale or slightly rufous tomentum gradually disappearing before winter, becoming dark red and lustrous, dull red-brown in their second year, and then gradually growing slightly darker until the bark separates into the thin flakes of the older branches; or often sending up from the ground a clump of several small spreading stems forming a low bushy tree. **Winter-buds** ovoid, acute, about ¼′ long, covered in summer with thick pale tomentum, glabrous or slightly puberulous, lustrous and bright chestnut-brown in winter, the inner scales strap-shaped, light brown tinged with red, and coated with pale hairs. **Bark** on young stems and large branches thin, lustrous, light reddish brown or silvery gray, marked by narrow slightly darker longitudinal lenticels, separating freely into large thin papery scales persistent for several years, and turning back and showing the light pink-brown tints of the freshly exposed inner layers, becoming at the base of old trunks from ¾′–1′ thick, dark red-brown, deeply furrowed and broken on the surface into thick closely appressed scales. **Wood** light, rather hard, strong, close-grained, light brown, with pale sapwood of 40–50 layers of annual growth; used in the manufacture of furniture, woodenware, wooden shoes, and in turnery.

Distribution. Banks of streams, ponds, and swamps, in deep rich soil often inundated for several weeks at a time; near Manchester, Hillsboro County, New Hampshire, northeastern Massachusetts, Long Island, New York, southward to northern Florida through the region east of the Alleghany Mountains except in the immediate neighborhood of the

coast, through the Gulf states to the valley of the Navasota River, Brazos County, Texas, and through Arkansas, eastern Oklahoma, southeastern Kansas, and Missouri to Tennessee and Kentucky, southern and eastern Iowa, southern Minnesota, the valley of the Eau Claire River, Eau Claire County, Wisconsin, southern Illinois, the valley of the Kankakee River, Indiana, and southern Ohio; the only semiaquatic species and the only species ripening its seeds in the spring or early summer; attaining its largest size in the damp semitropical lowlands of Florida, Louisiana, and Texas; the only Birch-tree of such warm regions.

Often cultivated in the northeastern states as an ornamental tree, growing rapidly in cultivation.

4. Betula populifolia Marsh. Gray Birch. White Birch.

Leaves nearly triangular to rhombic, long-pointed, coarsely doubly serrate with stout spreading glandular teeth except at the broad truncate or slightly cordate or cuneate base, thin and firm, dark green and lustrous and somewhat roughened on the upper surface early in the season by small pale glands in the axils of the conspicuous reticulate veinlets, $2\frac{1}{2}'$–$3'$ long, $1\frac{1}{2}'$–$2\frac{1}{2}'$ wide, with a stout yellow midrib covered with minute glands, and raised and rounded on the upper side, and obscure yellow primary veins; turning pale yellow in the autumn; petioles slender, terete, covered with black glands, often stained with red on the upper side, $\frac{3}{4}'$–$1'$ long; stipules broadly ovate, acute, membranaceous, light green slightly tinged with red. **Flowers:** staminate aments usually solitary or rarely in pairs, $1\frac{1}{4}'$–$1\frac{1}{2}'$ long, about $\frac{1}{8}'$ thick during the winter, becoming $2\frac{1}{2}'$–$4'$ long, with ovate acute apiculate scales; pistillate aments slender, as long as their glandular peduncles about $\frac{1}{2}'$ in length,

Fig. 197

with ovate acute pale green glandular scales. **Fruit:** strobiles cylindric, pubescent, obtuse at apex, about $\frac{3}{4}'$ long and $\frac{1}{3}'$ thick, pendant or spreading on slender stems; nut ellipsoidal to obovoid, acute or rounded at base, a little narrower than its obovate wing.

A short-lived tree, 20°–30° or exceptionally 40° high, with a trunk rarely 18′ in diameter, short slender often pendulous more or less contorted branches usually clothing the stem to the ground and forming a narrow pyramidal head, and branchlets roughened by small raised lenticels, resinous-glandular when they first appear, gradually growing darker, bright yellow and lustrous before autumn like the young stems, bright reddish brown during their first winter, and ultimately white near the trunk; often growing in clusters of spreading stems springing from the stumps of old trees. **Winter-buds** ovoid, acute, pale chestnut-brown, glabrous, about $\frac{1}{4}'$ long. **Bark** about $\frac{1}{3}'$ thick, dull chalky white on the outer surface, bright orange on the inner, close and firm, with dark triangular markings at the

insertion of the branches, becoming at the base of old trees thicker, nearly black, and irregularly broken by shallow fissures. **Wood** light, soft, not strong, close-grained, not durable, light brown, with thick nearly white sapwood; used in the manufacture of spools, shoe-pegs and wood pulp, for the hoops of barrels, and largely for fuel.

Distribution. Dry gravelly barren soil or on the margins of swamps and ponds; Prince Edward Island, Nova Scotia, New Brunswick, and the valley of the lower St. Lawrence River southward to northeastern, central and on South Mountain, Franklin County, Pennsylvania, and northern Delaware, and westward through northern New England and New York, ascending sometimes to altitudes of 1800°, to the southern shores of Lake Ontario, and at the foot of Lake Michigan, Indiana; rare and local in the interior, very abundant in the coast region of New England and the middle states; springing up in great numbers on abandoned farm-lands or on lands stripped by fire of their original forest covering; most valuable in its ability to grow rapidly in sterile soil and to afford protection to the seedlings of more valuable and less rapid-growing trees.

A form with deeply divided leaves (var. *laciniata* Loud.) and one with purple leaves (var. *purpurea* E & B) are occasionally cultivated.

A shrub believed to be a natural hybrid of *B. populifolia* with *B. pumila* Michx. has been found near Mt. Mansfield, Vermont.

5. Betula cœrulea Blanch. Blue Birch.

Leaves ovate, long-pointed, broadly or narrowly concave-cuneate at the entire often unequal base, sharply mostly doubly serrate above with straight or incurved glandular often apiculate teeth, covered above when they unfold with pale deciduous glands, at maturity dull bluish green above, pale yellow-green below, and sparingly villose along the under side of the slender yellow midrib and primary veins, 2′–2½′ long, 1′–1½′ wide:

Fig. 198

petioles slender, ¾′–1¼′ long, yellow more or less deeply tinged with red. **Flowers:** staminate aments usually in pairs, or singly or in 3's, 1¼′–2′ long, about $\frac{3}{16}$′ thick, with ovate rounded short-pointed scales; pistillate aments slender, about ⅓′ long, with acuminate pale green much reflexed scales. **Fruit:** strobiles cylindric, pubescent, slightly narrowed at the obtuse apex, about 1′ long and ¼′ thick, pendant on slender peduncles ¼′–½′ in length; nut ellipsoidal, much narrower than its broad wing.

A tree, rarely more than 30° high, with a trunk 8′–10′ in diameter, small ascending finally spreading branches, and slender branchlets marked by numerous small raised pale lenticels, purplish and sparingly villose when they first appear, soon glabrous, becoming

bright red-brown; often forming clumps of several stems. **Bark** thin, white tinged with rose, lustrous, not readily separable into layers, the inner bark light orange color.

Distribution. Moist slopes, Stratton and Windham, Windham County, Vermont, at altitudes of about 1800° (*W. H. Blanchard*), Haystack Mountain, Aroostook County, Maine (*M. L. Fernald*); the American representative of the European *Betula pendula* Roth., and probably widely distributed over the hills of northern New England and eastern Canada. Perhaps with its variety best considered a natural hybrid between *B. papyrifera* and *B. populifolia*.

Apparently passing into a form with larger leaves often rounded and truncate at the broad base, 3′–3½′ long and 2′ wide, stouter staminate aments, and strobiles frequently 1½′ long and ½′ thick (var. *Blanchardii* Sarg. fig. 198 A). This under favorable conditions is a tree 60°–70° high, with a trunk 18′ in diameter; common with *Betula cœrulea* at Windham and Stratton, Vermont (*W. H. Blanchard*), and on a hill near the coast in Washington County, Maine (*M. L. Fernald*).

6. Betula papyrifera Marsh. Canoe Birch. Paper Birch.

Leaves ovate, acute or acuminate with a short broad point, coarsely usually doubly and often very irregularly serrate except at the rounded abruptly cuneate or gradually narrowed base, bright green, glandular-resinous, pubescent and clothed below on the midrib and primary veins and on the petioles with long white hairs when they unfold, at maturity thick and firm, dull dark green and glandless or rarely glandular on the upper surface, light yellow-green and glabrous or puberulous, with small tufts of pale hairs in the axils of the primary veins and covered with many black glands on the lower surface, 2′–3′ long, 1½′–2′ wide, with a slender yellow midrib marked, like the remote primary veins, with minute

Fig. 199

black glands, turning light clear yellow in the auutmn; petioles stout, yellow, glandular, glabrous or pubescent, ½′–¾′ long; stipules ovate, acute, ciliate on the margins with pale hairs, light green. **Flowers:** staminate aments clustered during the winter, ¾′–1¼′ long, about ⅛′ thick, with ovate, acute scales light brown below the middle, dark red-brown above it, becoming 3½′–4′ long, and about ⅓′ thick; pistillate aments 1′–1¼′ long, about $\frac{1}{16}$′ thick, with light green lanceolate scales long-pointed and acute or rounded at apex; styles bright red. **Fruit:** strobiles cylindric, glabrous, about 1½′ long and ⅓′ thick, hanging on slender stalks, their scales very rarely entire (var. *elobata* Sarg.); nut ellipsoidal, about $\frac{1}{16}$′ long, much narrower than its thin wing.

A tree, usually 60°–70° tall, with a trunk 2°–3° in diameter, becoming in old age, or when crowded by other trees, branchless below and supporting a narrow open head of

short pendulous branches, and branchlets at first light green, slightly viscid, marked by scattered orange-colored oblong lenticels and covered with long pale hairs, dark orange color and glabrous or pubescent during the summer, becoming dull red in their first winter, gradually growing dark orange-brown, lustrous for four or five years and ultimately covered with the white papery bark of older branches. **Winter-buds** obovoid, acute, about $\frac{1}{4}'$ long, pubescent below the middle and coated with resinous gum at midsummer, dark chestnut-brown, glabrous and slightly resinous during the winter, their inner scales becoming strap-shaped, rounded at apex, about $\frac{1}{2}'$ long and $\frac{1}{8}'$ wide. **Bark** on young trunks and large limbs thin, creamy white or rarely bronze color or orange-brown and lustrous on the outer surface, bright orange color on the inner, marked by long narrow slightly darker colored raised lenticels, separating into thin papery layers, pale orange color when first exposed to the light, becoming on old trunks for a few feet above the ground sometimes $\frac{1}{2}'$ thick, dull brown or nearly black, sharply and irregularly furrowed and broken on the surface into thick closely appressed scales. **Wood** light, strong, hard, tough, very close-grained, light brown tinged with red, with thick nearly white sapwood; largely used for spools, shoe-lasts, pegs, and in turnery, the manufacture of wood-pulp, and for fuel. The tough resinous durable bark impervious to water is used by all the northern Indians to cover their canoes and for baskets, bags, drinking-cups, and other small articles, and often to cover their wigwams in winter.

Distribution. Rich wooded slopes and the borders of streams, lakes, and swamps scattered through forests of other trees; Labrador to the southern shores of Hudson's Bay, and southward to Long Island, New York, northern Pennsylvania, central Michigan, northern Indiana, northern Wisconsin, northern-central Iowa, eastern Nebraska, North and South Dakota and Wyoming; common in the maritime provinces of Canada and North of the Great Lakes, and in northern New England and New York; small and comparatively rare in the coast region of southern New England and southward; on the highest mountains of New England and northward the var. *minor* S. Wats and Cov. is common as a small shrub.

Often planted in the northeastern states as an ornamental tree.

× *Betula Sandbergii* Britt. and its f. *maxima* Rosend. generally believed to be natural hybrids of *B. papyrifera* and *B. pumila* var. *glandulifera* Regl. occur in Tamarack swamps in Hennepin County, Minnesota.

Passing into the following varieties.

Betula papyrifera var. cordifolia Fern.

Leaves ovate, abruptly pointed and acuminate or acute at apex, cordate at base, coarsely doubly serrate, glabrous or pilose on the under side of the midrib and veins, often furnished

Fig. 200

below with axillary tufts of pale hairs, $1\frac{1}{2}'$–$3'$ long, $1'$–$2\frac{1}{2}'$ wide; petioles glabrous or rarely villose, $\frac{1}{2}'$–$\frac{3}{4}'$ in length. **Fruit:** strobiles $\frac{3}{4}'$–$2'$ long and $\frac{1}{4}'$–$\frac{1}{2}'$ thick, on villose peduncles up to $\frac{3}{4}'$ in length; scales glabrous or pubescent.

A tree rarely more than 30° tall, with slender glabrous or pubescent branchlets, and at high altitudes on the New England mountains reduced to a low shrub. **Bark** separating in thin layers, white or dark reddish brown.

Distribution. Labrador and Newfoundland to northern New England, and westward to the shores of Green Bay, Wisconsin, and those of Lake Superior, Minnesota (Grand Marais, Cook County); on Mt. Mitchell, North Carolina, at an altitude of 5550° (*W. W. Ashe*).

Betula papyrifera var. subcordata Sarg.

Betula subcordata Rydb.

Leaves ovate, acute or acuminate at apex, slightly cordate or rounded at base, rarely slightly lobed above the middle, finely often doubly serrate with teeth pointing forward or spreading, glabrous, $2'$–$2\frac{1}{2}'$ long, $1'$–$1\frac{1}{2}'$ wide; petioles sparingly villose or glabrous, $\frac{1}{2}'$–$\frac{3}{4}'$ in length. **Fruit:** strobiles drooping on slender peduncles $1'$–$1\frac{1}{2}'$ long, about $\frac{1}{3}'$ thick,

Fig. 201

their scales puberulous, ciliate on the margins, the middle lobe acute, rather longer than the broad truncate lateral lobes; nut obovoid, cuneate at base, $\frac{1}{12}'$ long, narrower than its wings.

A tree 25°–40° or occasionally 60° high, with a trunk 12′–18′ in diameter, and slightly glandular glabrous red-brown branchlets. **Bark** separating freely into thin layers, white or occasionally dark reddish brown or orange color.

Distribution. Alberta (Crow Nest Pass, neighborhood of Jasper and Cypress Hills), through northern Montana and Idaho to western Washington, northeastern Oregon (Minum River Valley) and British Columbia.

Betula papyrifera var. montanensis Sarg.

Betula montanensis Butler.

Leaves broadly ovate, acute at apex, truncate or rounded at base to oblong-ovate or lanceolate and long-pointed and acuminate at apex, narrowed and rounded at base, coarsely doubly serrate, thick, dark green above, paler, sparingly pubescent and furnished with

conspicuous tufts of axillary hairs below, 3′–5′ long, 2′–2¼′ wide; petioles puberulous, ¾′–1′ in length. **Flowers** unknown. **Fruit**: strobiles cylindric, 1¾′–2′ long, ½′ thick, pendent on puberulous peduncles ½′–¾′ in length, their scales puberulous, finely ciliate on

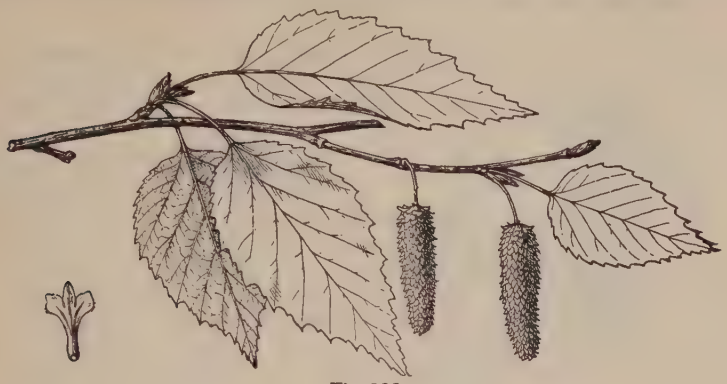

Fig. 202

the margins, the slender base of those below the middle of the ament rather more than twice as long as the expanded upper portion of the scale.

A tree 40°–50° high, with a trunk 12′–18′ in diameter, and slender branchlets red-brown, lustrous, marked by small pale lenticels and puberulous during their first season. **Winter-buds** narrow-obovoid, acuminate, dark red-brown, resinous, ⅓′ long. **Bark** white, or dark gray or brown.

Distribution. Shore of Yellow Bay, Flathead Lake, Flathead County, Montana, and at Sandpoint, Bonner County, Idaho.

Betula papyrifera var. occidentalis Sarg.

Betula occidentalis Hook.

Leaves ovate, acute, or abruptly acuminate at apex, rounded or occasionally cordate or rarely cuneate at the broad base, coarsely and generally doubly serrate with straight or incurved glandular teeth, thin and firm in texture, dull dark green above, pale yellow-green below, and puberulous on both sides of the stout yellow midrib and slender primary veins, 3′–4′ long, 1½′–2′ wide; petioles stout, glandular, at first tomentose, ultimately pubescent or puberulous, about ¾′ long; stipules oblong-obovate, rounded and acute or apiculate at apex, ciliate on the margin, puberulous, glandular-viscid. **Flowers**: staminate aments during the winter about ¾′ long and ⅛′ thick, with ovate scales rounded or abruptly narrowed and acute at apex, puberulous on the outer surface, ciliate on the margins, becoming 3′–4′ long and about ¼′ thick; pistillate aments about 1′ long and 1/16′ thick, with acuminate bright green scales. **Fruit**: strobiles cylindric, puberulous, spreading, 1¼′–1½′ long, ¼′–½′ thick, on stout peduncles ¾′ in length, their scales ciliate on the margins; nut oval, about 1/16′ in length, and nearly as wide as its wings.

A tree, 100°–120° high, with a trunk 3°–4° in diameter, comparatively small branches often pendulous on old trees, and pale orange-brown branchlets more or less glandular and coated with long pale hairs when they first appear, becoming bright orange-brown and nearly destitute of glands during their first winter, and in their second year orange-brown, glabrous, and very lustrous. **Winter-buds** acute, bright orange-brown, ⅛′–¼′ long, their light brown inner scales sometimes becoming ¾′ in length. **Bark** thin, marked by long oblong horizontal raised lenticels, dark orange-brown or white, very lustrous, sepa-

rating freely into thin papery layers displaying in falling the bright orange-yellow inner bark.

Distribution. Banks of streams and lakes; southwestern British Columbia and northwestern Washington and eastward through eastern Washington and northern Idaho to

Fig. 203

northern Montana west of the continental divide; nowhere common and probably of its largest size on the alluvial banks of the lower Fraser River, and on the islands of Puget Sound.

Betula papyrifera var. kenaica A. Henry. Red Birch. Black Birch.

Betula kenaica Evans.

Leaves ovate, acute or acuminate, broadly cuneate or somewhat rounded at the entire base, irregularly coarsely often doubly serrate, glabrous, dark dull green above, pale yel-

Fig. 204

low-green below, $1\frac{1}{2}'$–$2'$ long, $1'$–$1\frac{3}{4}'$ wide, with a slender yellow midrib and 5 pairs of thin primary veins; petioles slender, $\frac{3}{4}'$–$1'$ long. **Flowers:** staminate aments clustered, $1'$ long,

with ovate acute scales apiculate at apex, puberulous on the outer surface; pistillate aments, $\frac{1}{3}'$–$\frac{1}{2}'$ long, about $\frac{1}{16}'$ thick, on slender glandular pubescent peduncles $\frac{1}{2}'$–$\frac{3}{4}'$ in length; scales acuminate light green strongly reflexed; styles bright red. **Fruit:** strobiles cylindric, glabrous, 1′ long, their scales ciliate on the margins; nut oval, somewhat narrower than its thin wing.

A tree, 30°–40° high, with a trunk 12′–20′ in diameter, wide-spreading branches, stout branchlets marked by numerous small pale lenticels, bright red-brown during 2 or 3 years, gradually becoming darker. **Bark** thin, more or less furrowed, very dark brown or nearly black near the base of the trunk, grayish white or light reddish brown and separating into thin layers higher on the stem and on the branches.

Distribution. Coast of Alaska from Cook Inlet southward to the head of the Lynn Canal.

7. Betula alaskana Sarg. White Birch.

Leaves rhombic to deltoid-ovate, long-pointed, truncate, rounded or broadly cuneate, or on leading shoots occasionally cordate at the entire base, coarsely and often doubly glandular-serrate, thin, dark green above, pale and yellow-green below, $1\frac{1}{2}'$–3′ long, 1′–$1\frac{1}{2}'$ wide, with a slender midrib and primary veins pubescent or ultimately glabrous below; petioles often bright red, somewhat hairy at first, finally glabrous, about 1′ long; **Flowers:** staminate aments clustered, sessile, 1′ long, $\frac{1}{8}'$ thick, with ovate acuminate scales

Fig. 205

puberulous on the outer surface, and bright red, with yellow margins; pistillate aments slender, cylindric, glandular, 1′ long, $\frac{1}{8}'$ thick, on stout peduncles nearly $\frac{1}{2}'$ in length. **Fruit:** strobiles glabrous, pendulous or spreading, 1′–$1\frac{1}{4}'$ long, $\frac{3}{4}'$–$\frac{1}{2}'$ thick, their scales ciliate on the margins; nut oval, narrower than its broad wing.

A tree, usually 30°–40°, occasionally 80°, high, with a trunk 6′–12′ in diameter, slender erect and spreading or pendulous branches, and glabrous bright red-brown branchlets more or less thickly covered during their first year with resinous glands sometimes persistent until the second or third season. **Winter-buds** ovoid, obtuse at the gradually narrowed apex, about $\frac{1}{4}'$ long, with light red-brown shining outer scales sometimes ciliate on the margins, and oblong rounded scarious inner scales hardly more than $\frac{1}{2}'$ long when fully grown. **Bark** thin, marked by numerous elongated dark slightly raised lenticels, dull reddish brown or sometimes nearly white on the outer surface, light red on the inner surface, close and firm, finally separable into thin plate-like scales.

Distribution. Valley of the Saskatchewan northwestward to the valley of the Yukon,

growing sparingly near the banks of streams in forests of coniferous trees and in large numbers on sunny slopes and hillsides; the common Birch-tree of the Yukon basin.

× *Betula commixta* Sarg., a shrub, growing on the tundra near Dawson, Yukon Territory, is believed to be a hybrid between *B. alaskana* and *B. glandulosa* Michx.

8. Betula fontinalis Sarg. Black Birch.

Leaves ovate, acute or acuminate, sharply and often doubly serrate, except at the rounded or abruptly cuneate often unequal base, and sometimes slightly laciniately lobed, pale green, pilose above, and covered by conspicuous resinous glands when they unfold, at maturity thin and firm, dark dull green above, pale yellow-green, rather lustrous and covered by minute glandular dots below, 1′–2′ long, ¾′–1′ wide, with a slender pale midrib, remote glandular veins, and rather conspicuous reticulate veinlets; turning dull yellow in the autumn; petioles stout, puberulous, light yellow, glandular-dotted, flattened on the upper side, often flushed with red, ⅓′–½′ long; stipules broadly ovate, acute or rounded at apex, slightly ciliate, bright green, soon becoming pale and scarious. **Flowers:** staminate aments clustered, ½′–¾′ long and $\frac{1}{16}$′ thick during the winter, with ovate acute light chestnut-brown scales pale and slightly ciliate on the margins, becoming 2′–2½′ long, and about ⅛′ thick, with apiculate scales; pistillate aments short-stalked, about ¾′ long, with ovate acute green scales; styles bright red. **Fruit:** strobiles cylindric, rather obtuse, puberulous or nearly glabrous, 1′–1¼′ long, ½′ thick, erect or pendulous on

Fig. 206

slender glandular peduncles, ¼′ to nearly ¾′ in length; their scales ciliate, puberulous, the lateral lobes ascending, shorter than the middle lobe; nut ovoid or obovoid, puberulous at apex, nearly as wide as its wing.

A tree 20°–25° high with a short trunk, rarely more than 12′ or 14′ in diameter, ascending spreading and somewhat pendulous branches forming a broad open head, and slender branchlets, when they first appear light green glabrous or puberulous and covered with lustrous resinous glands persistent during their second season, and dark red-brown in their first winter; more commonly shrubby, with many thin spreading stems forming open clusters, 15°–20° high; often much lower, and frequently crowded in almost impenetrable thickets. **Winter-buds** ovoid, acute, very resinous, chestnut-brown, ¼′ long. **Bark** about ¼′ thick, dark bronze color, very lustrous, marked by pale brown longitudinal lenticels becoming on old trunks often 6′–8′ long and ¼′ wide. **Wood** soft and strong, light brown, with thick lighter-colored sapwood; sometimes used for fuel and fencing.

Distribution. Moist soil near the banks of streams usually in mountain cañons; gen-

erally distributed, although nowhere very common: valley of the Saskatchewan (Saskatoon), Saskatchewan, westward to the basin of the upper Fraser and Pease Rivers, British Columbia, southward along the Rocky Mountains to eastern Utah, northern New Mexico and Arizona, the valleys of the Shasta region and the eastern slope of the Sierra Nevada, northern California, and eastward in the United States to the eastern foothills of the Rocky Mountains of Colorado, the Black Hills of South Dakota, and northwestern Nebraska. Passing into

Betula fontinalis var. Piperi Sarg.

Betula Piperi Britt.

A tree occasionally 50°–60° high with a tall trunk 12′–18′ in diameter, short spreading branches, and usually longer and often narrower strobiles.

Fig. 207

Distribution. Spokane, Spokane County, Almota and Pullman, Whitman County, eastern Washington.

9. **Betula Eastwoodæ Sarg.**

Leaves broad-ovate to elliptic, acute, rounded or abruptly short-pointed at apex, coarsely serrate except at the cuneate base, thick, glabrous, dark green above, pale below, reticulate-

Fig. 208

venulose, the veinlets more conspicuous on the lower surface, 1′–1½′ long, ¾′–1½′ wide; petioles slender, glabrous ⅛′–⅓′ in length; stipules scarious, ovate-oblong, rounded at apex. **Flowers:** staminate aments usually solitary or in pairs, sessile, 1′–1¼′ long, ⅕′ thick, with broadly ovate pubescent dark red scales acute and apiculate at apex; pistillate aments ½′ long, about 1/12′ thick, with acute light green scales. **Fruit:** strobiles pendulous on peduncles ⅓′–½′ long, cylindric, ¾′ in length, about ⅛′ thick, their scales glabrous longer than broad, the lobes narrowed at the rounded apex, ciliate, the lateral slightly spreading, one third shorter than the terminal lobe.

A tree 18°–20° high, with a trunk rarely more than 6′ in diameter, and slender red glabrous branchlets thickly covered with circular white glands. **Bark** close, chestnut-brown, marked by conspicuous horizontal white lenticels, about ⅛′ thick.

Distribution. Swamps near Dawson, Yukon Territory, forming jungles with *Betula glandulosa* Michx., *B. alaskana* Sarg., and various Willows; as a large shrub in Jasper Park near Jasper, Alberta.

4. ALNUS L. Alder.

Trees and shrubs, with astringent scaly bark, soft straight-grained wood, naked stipitate winter-buds formed in summer and nearly inclosed by the united stipules of the first leaf, becoming thick, resinous, and dark red. Leaves open and convex in the bud, falling without change of color; stipules of all but the first leaf ovate, acute, and scarious. Flowers vernal, or rarely opening in the autumn from aments of the year, in 1–3-flowered cymes in the axils of the peltate short-stalked scales of stalked aments formed in summer or autumn in the axils of the last leaves of the year or of those of minute leafy bracts; staminate aments elongated, pendulous, paniculate, naked and erect during the winter, each staminate flower subtended by 3–5 minute bractlets adnate to the scales of the ament, and composed of a 4-parted calyx, and 1–3 or usually 4 stamens inserted on the base of the calyx opposite its lobes, with short simple filaments; pistillate aments ovoid or oblong, erect, stalked, produced in summer in the axils of the leaves of a branch developed from the axils of an upper leaf of the year, and below the staminate inflorescence, inclosed at first in the stipules of the first leaf, emerging in the autumn and naked during the winter, or remaining covered until early spring; pistillate flowers in pairs, each flower subtended by 2–4 minute bractlets adnate to the fleshy scale of the ament becoming at maturity thick and woody, obovate, 3–5-lobed or truncate at the thickened apex, forming an ovoid or subglobose strobile persistent after the opening of its closely imbricated scales; calyx 0; ovary compressed; nut minute, bright chestnut-brown, ovoid to oblong, flat, bearing at the apex the remnants of the style, marked at the base by a pale scar, the outer coat of the shell produced into lateral wings often reduced to a narrow membranaceous border.

Alnus inhabits swamps, river bottom-lands, and high mountains, and is widely and generally distributed through the northern hemisphere, often forming the most conspicuous feature of vegetation on mountain slopes, ranging at high altitudes southward in the New World through Central America to Colombia, Peru, and Bolivia, and to upper Assam and Japan in the Old World. Of the eighteen or twenty species now recognized nine are North American; of these, six attain the size and habit of trees. Of the exotic species, *Alnus vulgaris* Hill., a common European, north African, and Asiatic timber-tree, was introduced many years ago into the northeastern states, where it has become locally naturalized. The wood of Alnus is very durable in water, and the astringent bark and strobiles are used in tanning leather and in medicine.

Alnus is the classical name of the Alder.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT SPECIES.

Flowers opening in spring with or after the leaves; stamens 4; pistillate aments inclosed during the winter; wing of the nut broad; leaves ovate, sinuately lobed, lustrous on the lower surface. **1. A. sinuata** (B, F, G).

Flowers opening in winter or early spring before the unfolding of the leaves; pistillate aments usually naked during the winter.

Wing of the nut broad; leaves ovate or elliptic, rusty-pubescent on the lower surface; pistillate aments often inclosed during the winter; stamens 4. **2. A. rubra** (B, G).

Wing of the nut reduced to a narrow border.

Stamens 4; leaves oblong-ovate, glabrous or puberulous on the lower surface. **3. A. tenuifolia** (B, F, G).

Stamens usually 2, or 3.

Leaves ovate or oval. **4. A. rhombifolia** (B, F, G).

Leaves oblong-lanceolate, acute. **5. A. oblongifolia** (H).

Flowers opening in autumn from aments of the year; stamens 4; wing of the nut reduced to a narrow border; leaves oblong-ovate or obovate, dark green and lustrous above, pale yellow-green below. **6. A. maritima** (A).

1. Alnus sinuata Rydb. Alder.

Alnus sitchensis Sarg.

Leaves ovate, acute, full and rounded and often unsymmetrical and somewhat oblique or abruptly narrowed and cuneate at base, divided into numerous short acute lateral lobes, sharply and doubly serrate with straight glandular teeth, glandular-viscid as they unfold, at maturity membranaceous, yellow-green on the upper surface, pale and very lustrous on

Fig. 209

the lower surface, glabrous, or villose along the under side of the stout midrib with short brown hairs also forming tufts in the axils of the numerous slender primary veins, 3′–6′ long, 1½′–4′ wide; petioles stout, grooved, abruptly enlarged at the base, ½′–¾′ in length; stipules oblong to spatulate, rounded and apiculate at apex, puberulous, about ¼′ long. **Flowers:** staminate aments sessile, in pairs in the axils of the upper leaves sometimes reduced to small bracts, and single in the axil of the leaf next below, during the winter about ½′ long and ⅛′ thick, with dark red-brown shining puberulous apiculate scales, becoming when the flowers open from spring to midsummer 4′ or 5′ long, with a puberulous light red rachis and ovate acute apiculate 3-flowered scales; calyx-lobes rounded, shorter than the 4 stamens; pistillate aments in elongated panicles, inclosed during winter in buds formed the previous summer in the axils of the leaves of short lateral branchlets, long-pedunculate, ⅓′ long, ⅛′ thick. **Fruit:** strobiles on slender peduncles in elongated sometimes leafy panicles 4′–6′ in length, oblong, ½′–⅝′ long, about ⅓′ thick, their truncate scales thickened at the apex; nut oval, about as wide as its wings.

A tree, sometimes 40° high, with a trunk 7′–8′ in diameter, short small nearly horizontal branches forming a narrow crown, and slender slightly zigzag branchlets puberulous and very glandular when they first appear, bright orange-brown and lustrous and marked by numerous large pale lenticels during their first season, much roughened during their second year by the elevated crowded leaf-scars, becoming light gray. **Winter-buds** acuminate, dark purple, covered especially toward the apex with close fine pubescence, about $\frac{1}{2}'$ long. **Bark** thin bluish gray, with bright red inner bark; often a shrub only a few feet tall spreading into broad thickets.

Distribution. Northwest coast from the borders of the Arctic Circle to the high mountains of northern California; common in the valley of the Yukon and eastward through British Columbia to Alberta, and through Washington and Oregon to the western slopes of the Rocky Mountains in Montana; at the north with dwarf Willows, forming great thickets; in southeastern Alaska often a tall tree on rich moist bottom-lands near the mouths of mountain streams, and at the upper limits of tree growth a low shrub; very abundant in the valley of the Yukon on the wet banks of streams and often arborescent in habit; in British Columbia and the United States generally smaller and a shrub, growing usually only at altitudes of more than 3000° above the sea, and often forming thickets on the banks of streams and lakes.

2. Alnus rubra Bong. Alder.

Alnus oregona Nutt.

Leaves ovate to elliptic, acute, abruptly or gradually narrowed and cuneate at base, crenately lobed, dentate with minute gland-tipped teeth, and slightly revolute on the margins, covered when they unfold with pale tomentum, at maturity thick dark green and glabrous or pilose with scattered white hairs above, clothed below with short rusty pubes-

Fig. 210

cence, 3′–5′ long, $1\frac{3}{4}'$–3′ wide, or on vigorous branchlets sometimes 8′–10′ long, with a broad midrib and primary veins green on the upper side and orange-colored on the lower, the primary veins running obliquely to the points of the lobes and connected by conspicuous slightly reticulate cross veinlets; petioles orange-colored, nearly terete, slightly grooved, $\frac{1}{4}'$–$\frac{3}{4}'$ in length; stipules ovate, acute, pale green flushed with red, tomentose, $\frac{1}{8}'$–$\frac{1}{4}'$ long. **Flowers:** staminate aments in red-stemmed clusters, during the winter $1\frac{1}{4}'$ long, $\frac{1}{8}'$ thick, with dark red-brown lustrous closely appressed scales, becoming 4′–6′ long and $\frac{1}{4}'$ thick, with ovate acute orange-colored glabrous scales; calyx yellow, with ovate rounded

lobes rather shorter than the 4 stamens; pistillate aments in short racemes usually inclosed during the winter in buds formed during the early summer and opening in the early spring, $\frac{1}{3}'$–$\frac{1}{2}'$ long, about $\frac{1}{16}'$ thick, with dark red acute scales; styles bright red. **Fruit:** strobiles raised on stout orange-colored peduncles sometimes $\frac{1}{2}'$ in length, ovoid or oblong, $\frac{1}{2}'$–$1'$ long, $\frac{1}{3}'$–$\frac{1}{2}'$ thick, with truncate scales much thickened toward the apex; nut orbicular to obovoid, surrounded by a membranaceous wing.

A tree, usually 40°–50°, occasionally 90° high, with a trunk sometimes 3° in diameter, slender somewhat pendulous branches forming a narrow pyramidal head, and slender branchlets marked by minute scattered pale lenticels, light green and coated at first with hoary tomentum sometimes persistent until their second year, becoming during the first winter bright red and lustrous and ultimately ashy gray. **Winter-buds** about $\frac{1}{3}'$ long, dark red, covered with pale scurfy pubescence. **Bark** rarely more than $\frac{3}{4}'$ thick, close, roughened by minute wart-like excrescences, pale gray or nearly white, with a thin outer layer, and bright red-brown inner bark. **Wood** light, soft, brittle, not strong, close-grained, light brown tinged with red, with thick nearly white sapwood; in Washington and Oregon largely used in the manufacture of furniture and for smoking salmon; by the Indians of Alaska the trunks are hollowed into canoes.

Distribution. Shores of Yakutat Bay, southeastern Alaska, southward near the coast to the cañons of the Santa Inez Mountains, Santa Barbara County, California; common along the banks of streams, and of its largest size near the shores of Puget Sound; in California most abundant in Mendocino, Humbolt and Marin Counties, forming groves on bottom-lands near the coast; often ranging inland for 20 or 30 miles, and occasionally ascending to altitudes of 2000° above the sea.

3. Alnus tenuifolia Nutt. Alder.

Leaves ovate-oblong, acute or acuminate, broad and rounded or cordate or occasionally abruptly narrowed and cuneate at base, usually acutely laciniately lobed and doubly ser-

Fig. 211

rate, when they unfold light green often tinged with red, pilose on the upper surface and coated on the lower with pale tomentum, at maturity thin and firm, dark green and glabrous above, pale yellow-green and glabrous or puberulous below, $2'$–$4'$ long, $1\frac{1}{2}'$–$2\frac{1}{2}'$ wide, with a stout orange-colored midrib impressed on the upper side, and slender primary veins running to the points of the lobes; petioles stout, slightly grooved, orange-colored, $\frac{1}{2}'$–$1'$ in length; stipules ovate, acute, thin, and scarious, $\frac{1}{2}'$ long, about $\frac{1}{8}'$ wide, covered with pale pubescence. **Flowers:** staminate aments 3 or 4 in number in slender-stemmed racemes, nearly sessile or raised on stout peduncles often $\frac{1}{2}'$ long, during the winter light purple, $\frac{3}{4}'$–$1'$ long

and $\frac{1}{4}'$ thick, becoming $1\frac{1}{2}'$–$2'$ in length; calyx-lobes rounded, shorter than the 4 stamens; pistillate aments naked during the winter, dark red-brown, nearly $\frac{1}{4}'$ long, with acute apiculate loosely imbricated scales, only slightly enlarged when the flowers open. **Fruit:** strobiles obovoid-oblong, $\frac{1}{3}'$–$\frac{1}{2}'$ long, their scales much thickened, truncate and 3-lobed at apex; nut nearly circular to slightly obovoid, surrounded by a thin membranaceous border.

A tree, occasionally 30° tall, with a trunk 6′–8′ in diameter, small spreading slightly pendulous branches forming a narrow round-topped head, and slender branchlets marked at first by a few large orange-colored lenticels and coated with fine pale or rusty caducous pubescence, becoming light brown or ashy gray more or less deeply flushed with red in their first winter and ultimately paler; more often shrubby, with several spreading stems, and at the north and at high altitudes frequently only 4°–5° tall. **Winter-buds** $\frac{1}{4}'$–$\frac{1}{3}'$ long, bright red, and puberulous. **Bark** rarely more than $\frac{1}{4}'$ thick, bright red-brown and broken on the surface into small closely appressed scales.

Distribution. Banks of streams and mountain cañons from Francis Lake in latitude 61° north to the valley of the lower Fraser River, British Columbia, eastward along the Saskatchewan to Prince Albert, and southward through the Rocky Mountains to northern New Mexico; on the Sierra Nevada of southern California, and in Lower California; the common Alder of mountain streams in the northern interior region of the continent; very abundant on the eastern slopes of the Cascade Mountains, and on the southern California Sierras; forming great thickets at 6000°–7000° above the sea along the head-waters of the rivers of southern California flowing to the Pacific Ocean; the common Alder of eastern Washington and Oregon, and of Idaho and Montana; very abundant and of its largest size in Colorado and northern New Mexico.

4. Alnus rhombifolia Nutt. White Alder. Alder.

Leaves ovate or oval or sometimes nearly orbicular, rounded or acute at apex, especially on vigorous shoots, gradually or abruptly narrowed and cuneate at base, finely or sometimes coarsely and occasionally doubly serrate, slightly thickened and reflexed on the some-

Fig. 212

what undulate margins, when they unfold pale green and covered with deciduous matted white hairs, at maturity dark green and lustrous on the upper surface, frequently marked, especially on the midrib, with minute glandular dots, light yellow-green and slightly puberulous below, 2′–3′ long, $1\frac{1}{2}'$–$2'$ wide, with a stout yellow midrib and primary veins; petioles slender, yellow, hairy, flattened and grooved on the upper side, $\frac{1}{2}'$–$\frac{3}{4}'$ long; stipules ovate, acute, scarious, puberulous, about $\frac{1}{4}'$ in length. **Flowers:** staminate aments in slender-stemmed pubescent clusters, usually short-stalked, during the summer dark olive-

brown and lustrous, $\frac{3}{4}'$–$1'$ long and about $\frac{1}{16}'$ thick, beginning to lengthen late in the autumn before the leaves fall, fully grown and $4'$–$6'$ long and $\frac{1}{4}'$ thick in January, with dark orange-brown scales, and deciduous in February before the appearance of the new leaves; calyx yellow, 4-lobed, rather shorter than the 2 or occasionally 3 or rarely single stamen; pistillate aments in short pubescent racemes emerging from the bud in December, their scales broadly ovate and rounded. **Fruit:** strobiles oblong, $\frac{1}{3}'$–$\frac{1}{2}'$ long, with thin scales slightly thickened and lobed at apex, fully grown at midsummer, remaining closed until the trees flower the following year; nut broadly ovoid, with a thin margin.

A tree, frequently 70°–80° high, with a tall straight trunk 2°–3° in diameter, long slender branches pendulous at the ends, forming a wide round-topped open head, and slender branchlets marked by small scattered lenticels, at first light green and coated with pale caducous pubescence, soon becoming dark orange-red and glabrous, and darker during the winter and following summer. **Winter-buds** nearly $\frac{1}{2}'$ long, very slender, dark red, and covered with pale scurfy pubescence. **Bark** on old trunks $1'$ thick, dark brown, irregularly divided into flat often connected ridges broken into oblong plates covered with small closely appressed scales. **Wood** light, soft, not strong, brittle, close-grained, light brown, with thick lighter colored often nearly white sapwood.

Distribution. Banks of streams from northern Idaho to the eastern slope of the Cascade Mountains of Washington and southeastern Oregon, and southward from the valley of the Willamette River, Oregon (near Salem, Marion County, *J. C. Nelson*) over the coast ranges and along the western slopes of the Sierra Nevada to the mountains of southern California (San Bernardino, San Jacinto, and Cuyamaca Ranges); the common Alder of the valleys of central California, occasionally ascending on the southern Sierra Nevada to altitudes of 8000°, and the only species at low altitudes in the southern part of the state.

5. Alnus oblongifolia Torr. Alder.

Alnus acuminata Sarg., not H. B. K.

Leaves oblong-lanceolate, acute; or rarely obovate and rounded at apex, gradually narrowed and cuneate at base, sharply and usually doubly serrate, more or less thickly covered, especially early in the season, with black glands, dark yellow-green and glabrous or slightly

Fig. 213

puberulous above, pale and glabrous or puberulous below, especially along the slender yellow midrib and veins, with small tufts of rusty hairs in the axils of the primary veins, $2'$–$3'$ long, about $1\frac{1}{2}'$ wide; petioles slender, grooved, pubescent, $\frac{3}{4}'$ long; stipules ovate-

lanceolate, brown and scarious, about $\frac{1}{4}'$ in length. **Flowers:** staminate aments in short stout-stemmed racemes, during the winter light yellow, $\frac{1}{2}'$–$\frac{3}{4}'$ long and about $\frac{1}{16}'$ thick, becoming when the flowers open at the end of February before the appearance of the leaves $2'$–$2\frac{1}{2}'$ in length, with ovate pointed dark orange-brown scales; calyx 4-lobed; stamens 3 or occasionally 2, with pale red anthers soon becoming light yellow; pistillate aments naked during the winter, $\frac{1}{8}'$ to nearly $\frac{1}{4}'$ long, with light brown ovate rounded scales; stigmas bright red. **Fruit:** strobiles $\frac{1}{2}'$–$1'$ long, with thin scales slightly thickened and nearly truncate at apex; nut broadly ovoid, with a narrow membranaceous border.

A tree, in the United States rarely more than 20°–30° high, with a trunk sometimes 8′ in diameter, long slender spreading branches forming an open round-topped head, and slender branchlets slightly puberulous when they first appear, light orange-red and lustrous during their first winter, and marked by small conspicuous pale lenticels, becoming in their second year dark red-brown or gray tinged with red and much roughened by the elevated leaf-scars. **Winter-buds** acute, red, lustrous, glabrous, $\frac{1}{2}'$ long. **Bark** thin, smooth, light brown tinged with red.

Distribution. Banks of streams in cañons of the mountains of southern New Mexico and Arizona at altitudes of 4000°–6000° above the sea; in Oak Creek Cañon near Flagstaff, northern Arizona (tree 100° × 3°, *P. Lowell*); and on the mountains of northern Mexico.

6. Alnus maritima Nutt. Alder.

Leaves oblong-ovate, or obovate, acute, acuminate or rounded at apex, gradually narrowed and cuneate at base, remotely serrate with minute incurved glandular teeth, and somewhat thickened on the slightly undulate margins, when they unfold, light green tinged with red, hairy on the midrib, veins, and petioles, and coated above with pale scurfy

Fig. 214

pubescence, at maturity dark green, very lustrous, and covered below by minute pale glandular dots, $3'$–$4'$ long, $1\frac{1}{2}'$–$2'$ wide, with a stout yellow midrib and primary veins prominent and glandular on the upper side and slightly puberulous below; petioles stout, yellow, glandular, flattened and grooved on the upper side, $\frac{1}{2}'$–$\frac{3}{4}'$ in length; stipules oblong, acute, about $\frac{1}{8}'$ long, dark reddish brown, caducous. **Flowers** opening in the autumn: aments appearing in July on branches of the year and fully grown in August or early in September; staminate in short scurfy-pubescent glandular-pitted racemes on slender peduncles sometimes $1'$ in length from the axils of upper leaves, covered at first with ovate acute dark green very lustrous scales slightly ciliate on the margins and furnished at apex with minute red points, at maturity $1\frac{1}{2}'$–$2\frac{1}{2}'$ long, $\frac{1}{4}'$ to nearly $\frac{1}{2}'$ thick, with dark orange-brown scales raised on slender stalks, and 4 bright orange-colored stamens; pistillate usually sol-

itary from the axils of the lower leaves on stout pubescent peduncles, bright red at apex and light green below before opening, with ovate acute scales slightly ciliate on the margins, about $\frac{1}{8}'$ long when the styles protrude from between the scales, beginning to enlarge the following spring. **Fruit** attaining full size at midsummer and then raised on a stout peduncle, broadly ovoid, rounded and depressed at base, gradually narrowed to the rather obtuse apex, about $\frac{5}{8}'$ long and $\frac{1}{2}'$ broad, with thin lustrous scales slightly thickened and crenately lobed at apex, turning dark reddish brown or nearly black and opening late in the autumn and remaining on the branches until after the flowers open the following year; nut oblong-obovoid, gradually narrowed and apiculate at apex, with a thin membranaceous border.

A tree, occasionally 30° high, with a tall straight trunk 4′–5′ in diameter, small spreading branches forming a narrow round-topped head, slender slightly zigzag branchlets, light green and hairy at first, pale yellow-green, very lustrous, slightly puberulous, marked with occasional small orange-colored lenticels, and glandular with minute dark glandular dots during their first summer, becoming dull light orange or reddish brown in the winter, and ashy gray often slightly tinged with red the following season; more often shrubby, with numerous slender spreading stems 15°–20° tall. **Winter-buds** acute, dark red, coated with pale lustrous scurfy pubescence, about $\frac{1}{4}'$ long. **Bark** $\frac{1}{8}'$ thick, smooth, light brown or brown tinged with gray. **Wood** light, soft, close-grained, light brown, with thick hardly distinguishable sapwood.

Distribution. Banks of streams and ponds in southern Delaware and Maryland, and in south central Oklahoma (Johnson and Bryan Counties).

Occasionally cultivated as an ornamental tree in the eastern states and hardy as far north as Massachusetts.

X. FAGACEÆ.

Trees, with watery juice, slender terete branchlets marked by numerous usually pale lenticels, alternate stalked penniveined leaves, and narrow mostly deciduous stipules. Flowers monœcious, the staminate in unisexual heads or aments, composed of a 4–8-lobed calyx, and 4 or 8 stamens, with free simple filaments and introrse 2-celled anthers, the cells parallel and contiguous, opening longitudinally; the pistillate solitary or clustered, in terminal unisexual or bisexual spikes or heads, subtended by an involucre of imbricated bracts becoming woody and partly or entirely inclosing the fruit, and composed of a 4–8-lobed calyx adnate to the 3–7-celled ovary with as many styles as its cells and 1 or 2 pendulous anatropous or semi-anatropous ovules in each cell. Fruit a nut 1-seeded by abortion, the outer coat cartilaginous, the inner membranaceous or bony. Seed filling the cavity of the nut, without albumen; seed-coat membranaceous; cotyledons fleshy, including the minute superior radicle; hilum, basal, minute.

The six genera of this widely distributed family occur in North America with the exception of Nothofagus, separated from Fagus to receive the Beech-trees of the southern hemisphere.

CONSPECTUS OF THE NORTH AMERICAN GENERA.

Staminate flowers fascicled in globose-stalked heads; the pistillate in 2–4-flowered clusters. **1. Fagus.**

Staminate flowers in slender aments.

Pistillate flowers in 2–5-flowered clusters below the staminate, in bisexual aments.

Nut inclosed in a prickly burr.

Leaves deciduous; ovary 6-celled; nut maturing in one season; branchlets lengthening by an upper axillary bud; bud-scales 4. **2. Castanea.**

Leaves persistent; ovary 3-celled; nut maturing at the end of the second season; branchlets lengthening by a terminal bud; bud-scales numerous. **3. Castanopsis.**

Nut inclosed only partly in a shallow cup covered by slender recurved scales united only at the base, free above. **4. Lithocarpus.**

Pistillate flowers solitary, in few-flowered unisexual spikes; nut more or less inclosed in a cup covered by thin or thickened scales, closely appressed or often free toward its rim. **5. Quercus.**

1. FAGUS L. Beech.

Trees, with smooth pale bark, hard close-grained wood, and elongated acute bright chestnut-brown buds, their inner scales accrescent and marking the base of the branchlets with persistent ring-like scars. Leaves convex and plicate along the veins in the bud, thick and firm, deciduous; petioles short, nearly terete, in falling leaving small elevated semioval leaf-scars, with marginal rows of minute fibro-vascular bundle-scars; stipules linear-lanceolate, infolding the leaf in the bud. Flowers vernal after the unfolding of the leaves; staminate short-pedicellate, in globose many-flowered heads on long drooping bibracteolate stems at base of shoots of the year or from the axils of their lowest leaves, and composed of a subcampanulate 4–8-lobed calyx, the lobes imbricated in æstivation, ovate and rounded, and 8–16 stamens inserted on the base of and longer than the calyx, with slender filaments and oblong green anthers; pistillate in 2–4-flowered stalked clusters in the axils of upper leaves of the year, surrounded by numerous awl-shaped hairy bracts, the outer bright red, longer than the flowers, deciduous, the inner shorter and united below into a 4-lobed involucre becoming at maturity woody, ovoid, thick-walled, and covered by stout recurved prickles, inclosing or partly inclosing the usually 3 nuts, and ultimately separating into 4 valves; calyx urn-shaped, villose, divided into 4 or 5 linear-lanceolate acute lobes, its 3-angled tube adnate to the 3-celled ovary surmounted by 3 slender recurved pilose styles green and stigmatic toward the apex and longer than the involucre; ovules 2 in each cell. Nut ovoid, unequally 3-angled, acute or winged at the angles, concave and longitudinally ridged on the sides, chestnut-brown and lustrous, tipped with the remnants of the styles, marked at the base by a small triangular scar, with a thin shell covered on the inner surface with rufous tomentum. Seed dark chestnut-brown, suspended with the abortive ovules from the tip of the hairy dissepiment of the ovary pushed by the growth of the seed into one of the angles of the nut; cotyledons sweet, oily, plano-convex.

Fagus as here limited is confined to the northern hemisphere, with a single American species and seven Old World species; of these one is widely distributed through Europe, another is found in the Caucasus, and the others are confined to eastern temperate Asia. Of exotic species, the European *Fagus sylvatica* L., an important timber-tree, is frequently planted for ornament in the eastern states in several of its forms, especially those with purple leaves, and with pendulous branches. The wood of Fagus is hard and close-grained. The sweet seeds are a favorite food of swine, and yield a valuable oil.

Fagus is the classical name of the Beech-tree.

1. Fagus grandifolia Ehrh. Beech.

Fagus americana Sweet.

Leaves remote at the ends of the branches and clustered on short lateral branchlets, oblong-ovate, acuminate with a long slender point, coarsely serrate with spreading or incurved triangular teeth except at the gradually narrowed generally cuneate base, when they unfold pale green and clothed on the lower surface and margins with long pale lustrous silky hairs, at maturity dull dark bluish green above, light yellow-green, very lustrous, and glabrous or rarely pilose below (f. *pubescens* Fern. & Rehd.) with tufts of long pale hairs in the axils of the veins, $2\frac{1}{2}'$–$5'$ long, $1'$–$3'$ wide, with a slender yellow midrib covered above with short pale hairs, and slender primary veins running obliquely to the points of the teeth; turning bright clear yellow in the autumn; very rarely deeply laciniate; petioles hairy, $\frac{1}{4}'$–$\frac{1}{2}'$ in length; stipules ovate-lanceolate on the lower leaves, strap-shaped to linear-lanceolate on the upper, brown or often red below the middle, membra-

naceous, lustrous, 1′–1½′ long. **Flowers** opening when the leaves are about one third grown; staminate in globose heads 1′ in diameter, on slender hairy peduncles about 2′ long; pistillate in usually 2-flowered clusters, on short clavate hoary peduncles ½′–¾′ long. **Fruit:** involucres ½′–¾′ in length often shorter than the nuts, on stout hairy club-shaped peduncles ¼′–¾′ long, fully grown at midsummer, and then puberulous, dark orange-green, and covered by long slender recurved prickles red above the middle, becoming at maturity in the autumn light brown and tomentose, with crowded much recurved pubescent prickles, persistent on the branch after opening late into the winter; nut about ¾′ long.

A tree, usually 70°–80° but exceptionally 120° high, sending up from the roots numerous small stems sometimes extending into broad thickets round the parent tree, in the forest with a long comparatively slender stem free of branches for more than half its length, and short branches forming a narrow head, in open situations short-stemmed, with a trunk often 3°–4° in diameter, and numerous limbs spreading gradually and forming a broad com-

Fig. 215

pact round-topped head of slender slightly drooping branches clothed with short leafy laterals, and branchlets pale green and coated with long soft caducous hairs when they first appear, olive-green or orange-colored during their first summer, and conspicuously marked by oblong bright orange lenticels, gradually growing red, bright reddish brown during their first winter, darker brown in their second season and ultimately ashy gray. **Winter-buds** puberulous, especially toward the apex, ¾′ to nearly 1′ long, about ⅛′ broad, the inner scales hirsute on the inner surface and along the margins and when fully grown often 1′ long, lustrous, brown above the middle, and reddish below. **Bark** ¼′–½′ thick, with a smooth light steel-gray surface. **Wood** hard, strong, tough, very close-grained, not durable, difficult to season, dark or often light red, with thin nearly white sapwood of 20–30 layers of annual growth; largely used in the manufacture of chairs, shoe-lasts, plane-stocks, the handles of tools, and for fuel. The sweet nuts are gathered and sold in the markets of Canada and of some of the western and middle states.

Distribution. Rich uplands and mountain slopes, often forming nearly pure forests, and southward on the bottom-lands of streams and the margins of swamps; Nova Scotia, valley of the Restigouche River, New Brunswick, to the northern shores of Lake Huron and the southern shores of Lake Superior, and southward to Virginia, Ohio, Michigan, the ravines of Rock River near Oregon, Ogle County, Illinois, and Minnesota; southward passing into the var. *caroliniana* Fern. & Rehd., differing in its ovate to short-ovate thicker leaves, usually rounded or subcordate at base, and often less coarsely serrate or undulate on the

margins, glabrous or rarely densely soft pubescent below (f. *mollis* Fern. & Rehd.), in the often shorter involucre of the fruit with shorter and less crowded prickles; usually on the bottom-lands of streams and the borders of swamps, New Jersey, and southern Ohio and southeastern Missouri to western Florida, Alabama, Mississippi, Louisiana, eastern Texas, and northeastern Oklahoma; ascending on the southern Appalachian Mountains to altitudes of 4000° or over; probably growing to its largest size in eastern Louisiana.

The northern form is occasionally planted in the northern states as a shade and park tree.

2. CASTANEA Adans. Chestnut.

Trees or shrubs, with furrowed bark, porous brittle wood, durable in the ground, terete branchlets without terminal buds, axillary buds covered by 2 pairs of slightly imbricated scales, the outer lateral, the others accrescent, becoming oblong-ovate and acute and marking the base of the branch with narrow ring-like scars, and stout perpendicular tap-roots; producing when cut numerous stout shoots from the stump. Leaves convolute in the bud, ovate, acute, coarsely serrate, except at the base, with thin veins running to the points of the slender glandular teeth, deciduous; petioles leaving in falling small elevated semioval leaf-scars marked by an irregular marginal row of minute fibro-vascular bundle-scars; stipules ovate to linear-lanceolate, acute, scarious, infolding the leaf in the bud, caducous. Flowers opening in early summer, unisexual, strong-smelling; the staminate, in 3–7-flowered cymes, in the axils of minute ovate bracts, in elongated simple deciduous aments first appearing with the unfolding of the leaves from the inner scales of the terminal bud and from the axils of the lower leaves of the year, composed of a pale straw-colored slightly puberulous calyx deeply divided into 6 ovate rounded segments imbricated in the bud, and 10–20 stamens inserted on the slightly thickened torus, with filiform filaments incurved in the bud, becoming elongated and exserted, and ovoid or globose pale yellow anthers; the pistillate scattered or spicate at the base of the shorter persistent androgynous aments from the axils of later leaves, sessile, 2 or 3 together or solitary within a short-stemmed or sessile involucre of closely imbricated oblong acute bright green bracts scurfy-pubescent or tomentose below the middle, subtended by a bract and 2 lateral bractlets, each flower composed of an urn-shaped calyx, with a short limb divided into 6 obtuse lobes, minute sterile stamens shorter than the calyx-lobes, an ovary 6-celled after fecundation, with 6 linear spreading white styles hairy below the middle and tipped by minute acute stigmas, and 2 ovules in each cell, attached on its inner angle, descending, semianatropous. Fruit maturing in one season, its involucre inclosing 1–3 nuts, globose or short-oblong, pubescent or tomentose and spiny on the outer surface, with elongated ridged bright green ultimately brown branched spines fascicled between the deciduous scales, coated on the inner surface with lustrous pubescence, splitting at maturity into 2–4 valves; nut ovoid, acute, crowned by the remnants of the style, bright chestnut-brown and lustrous, tomentose or pubescent at apex, cylindrical, or when more than 1 flattened, marked at the broad base by a large conspicuous pale circular or oval thickened scar, its shell lined with rufous or hoary tomentum. Seed usually solitary by abortion, dark chestnut-brown, marked at apex by the abortive ovules, with thick and fleshy more or less undulate ruminate sweet farinaceous cotyledons.

Castanea is confined to the northern hemisphere, and is widely distributed through eastern North America, southern Europe, northern Africa, southwestern Asia, and central and northern China, Korea, and Japan. Seven species are distinguished. In the countries of the Mediterranean Basin much attention has been given to improving the fruit of the native species *Castanea sativa* Mill., which is occasionally planted in the middle United States; in Japan the seeds of *Castanea crenata* S. & Zucc. in many varieties and in China those of *Castanea mollissima* Bl. are important articles of food. Castanea produces coarse-grained wood very durable in contact with the soil, and rich in tannin. Chestnut-trees suffer in the eastern United States from the attacks of a fungus, *Endothia parasitica* Anders. which has nearly exterminated them in many parts of the country.

Castanea is the classical name of the Chestnut-tree.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Involucre of the fruit containing 2 or 3 flattened nuts. 1. **C. dentata** (A, C).
Involucre of the fruit containing a single terete nut.
Involucre of the fruit densely covered with spines; branchlets hoary tomentose. 2. **C. pumila** (A, C).
Involucre of the fruit covered with scattered spines; branchlets glabrous or sparingly pilose. 3. **C. alnifolia** (C).

1. Castanea dentata Borkh. Chestnut.

Leaves oblong-lanceolate, acute and long-pointed at apex, gradually narrowed and cuneate at base, when they unfold puberulous on the upper surface and clothed on the lower with fine cobweb-like tomentum, at maturity thin, glabrous, dark dull yellow-green above, pale yellow-green below, 6′–8′ long, about 2′ wide, with a pale yellow midrib and

Fig. 216

primary veins; turning bright clear yellow late in the autumn; petioles stout, slightly angled, puberulous, ½′ long, often flushed with red; stipules ovate-lanceolate, acute, yellow-green, puberulous, about ½′ long. **Flowers:** staminate aments about ½′ long when they first appear, green below the middle and red above, becoming when fully grown 6′–8′ long, with stout green puberulous stems covered from base to apex with crowded flower-clusters; androgynous aments, slender, puberulous, 2½′–5′ long, with 2 or 3 irregularly scattered involucres of pistillate flowers near their base. **Fruit:** involucre attaining its full size by the middle of August, 2′–2½′ in diameter, sometimes a little longer than broad, somewhat flattened at apex, pubescent and covered on the outer surface with crowded fascicles of long slender glabrous much-branched spines, opening with the first frost and gradually shedding their nuts; nuts usually much compressed, ½′–1′ wide, usually rather broader than long, coated at apex or nearly to the middle with thick pale tomentum, the interior of the shell lined with thick rufous tomentum; **seed** very sweet.

A tree, occasionally 100° high, with a tall straight columnar trunk 3°–4° in diameter, or often when uncrowded by other trees with a short trunk occasionally 10°–12° in diameter, and usually divided not far above the ground into 3 or 4 stout horizontal limbs forming a broad low round-topped head of slightly pendulous branches frequently 100° across, and branchlets at first light yellow-green sometimes tinged with red, somewhat angled, lustrous, slightly puberulous, soon becoming glabrous and olive-green tinged with yellow or brown

tinged with green and ultimately dark brown. **Winter-buds** ovoid, acute, about $\frac{1}{4}'$ long, with thin dark chestnut-brown scales scarious on the margins. **Bark** from 1′–2′ thick, dark brown and divided by shallow irregular often interrupted fissures into broad flat ridges separating on the surface into small thin closely appressed scales. **Wood** light, soft, not strong, liable to check and warp in drying, easily split, reddish brown, with thin lighter colored sapwood of 3 or 4 layers of annual growth; largely used in the manufacture of cheap furniture and in the interior finish of houses, for railway-ties, fence-posts, and rails. The nuts, which are superior to those of the Old World chestnuts in sweetness were formerly gathered in great quantities in the forest and sold in the markets of the eastern cities.

Distribution. Southern Maine to Woodstock, Grafton County, New Hampshire (rare) and to the valley of the Winooski River, Vermont, southern Ontario, and southern Michigan, southward to Delaware and Ohio, southern Indiana, and southwestern Illinois (Pulaski County) along the Appalachian Mountains up to altitudes of 4000° to northern Georgia, and to western Florida (Crestview, Okaloosa County), southeastern (Henry and Dale Counties) and south central (Dallas County) Alabama, northern, central and southeastern Mississippi (Pearl River County), and to central Kentucky and Tennessee; very common on the glacial drift of the northern states and, except at the north, mostly confined to the Appalachian hills; attaining its greatest size in western North Carolina and eastern Tennessee.

Formerly sometimes planted in the eastern states as an ornamental and timber tree, and for its nuts, of which several varieties have been recognized.

× *Castanea neglecta* Dode with leaves intermediate between those of *C. dentata* and *C. pumila* and an involucre containing a single large nut occurs on the Blue Ridge near Highlands, Macon County, North Carolina.

2. Castanea pumila Mill. Chinquapin.

Leaves oblong-elliptic to oblong-obovate, acute, coarsely serrate, with slender rigid spreading or incurved teeth, gradually narrowed and usually unequal and rounded or cuneate at

Fig. 217

base, when they unfold tinged with red and coated above with pale caducous tomentum and below with thick snowy white tomentum, at maturity rather thick and firm in texture, bright yellow-green on the upper surface, hoary or silvery pubescent on the lower, 3′–5′ long, $1\frac{1}{2}'$–2′ wide; turning dull yellow in the autumn; petioles stout, pubescent, flattened on the upper side, $\frac{1}{4}'$–$\frac{1}{2}'$ long; stipules light yellow-green, pubescent, those of the 2 lowest leaves broad, ovate, acute, covered at apex by rufous tomentum, on later leaves ovate-lanceolate, often oblique and acute, becoming linear at the end of the branch. **Flowers:**

staminate aments ½′ long when they first appear, pubescent, green below, bright red at apex, becoming when fully grown 4′–6′ long, with stout hoary tomentose stems and crowded or scattered flower-clusters; androgynous aments silvery tomentose, 3′–4′ long; involucres 1-flowered, scattered at the base of the ament or often spicate and covering its lower half, sessile or short-stalked. **Fruit:** involucre 1′–1½′ in diameter, with thin walls covered with crowded fascicles of slender spines tomentose toward the base; nut ovoid, terete, rounded at the slightly narrowed base, gradually narrowed and pointed at apex, more or less coated with silvery white pubescence, dark chestnut-brown, very lustrous, ¾′–1′ long, ⅓′ thick, with a thin shell lined with a coat of lustrous hoary tomentum, and a sweet seed.

A round-topped tree, rarely 50° high, with a short straight trunk 2°–3° in diameter, slender spreading branches, and branchlets coated at first with pale tomentum, becoming during their first winter pubescent or remaining tomentose at the apex, bright red-brown, glabrous, lustrous, olive-green or orange-brown during their second season and ultimately darker; east of the Mississippi River often a shrub spreading into broad thickets by prolific stolons, with numerous intricately branched stems often only 4° or 5° tall. **Winter-buds** ovoid, or oval, about ⅛′ long, clothed when they first appear in summer with thick hoary tomentum, becoming red during the winter and scurfy-pubescent. **Bark** ½′–1′ thick, light brown tinged with red, slightly furrowed and broken on the surface into loose plate-like scales. **Wood** light, hard, strong, coarse-grained, dark brown, with thin hardly distinguishable sapwood of 3 or 4 layers of annual growth; used for fence-posts, rails, and railways. The sweet nuts are sold in the markets of the western and southern states.

Distribution. Dry sandy ridges, rich hillsides and the borders of swamps; southern New Jersey and Pennsylvania to central (Lake County) and western Florida and westward through the Gulf States to the valley of the Neches River, Texas; on the Appalachian Mountains ascending to altitudes of 4500°; most abundant and of its largest size in southern Arkansas and eastern Texas. In Arkansas, southern Missouri, and eastern Oklahoma replaced by *C. ozarkensis* Ashe.

3. Castanea alnifolia Nutt. Chinquapin

A low shrub spreading into broad thickets by underground stems, with leaves pale pubescent on the lower surface; and distributed in the neighborhood of the coast from the valley of the Cape Fear River, North Carolina, to southern Georgia. Passing into

Castanea alnifolia var. floridana Sarg. Chinquapin

Leaves oblong-obovate to elliptic, acute, acuminate or rounded at apex, gradually narrowed and cuneate or rounded at base, irregularly sinuate-toothed with apiculate teeth,

Fig. 218

hoary tomentose below when they unfold, soon glabrous with the exception of the last leaves of vigorous summer shoots, and at maturity thin, glabrous, dark green above, light green and lustrous below, 3′–4′ long and 1′–1¾′ wide; petioles stout, glabrous, about ½′ in length. **Flowers:** staminate aments pale pubescent, 4′–5′ long; androgynous aments pubescent, as long or rather longer with ten or twelve involucres of pistillate flowers below the middle, often only the lowest being fertilized. **Fruit:** involucre 1-seeded, subglobose to short-oblong, pale tomentose, ¾′ to 1¼′ in diameter, covered with stout pubescent scattered spines divided at base into numerous branches; nut ovoid, terete, acute, dark chestnut-brown, lustrous, ½′ to nearly ¾′ in length.

A tree occasionally 40°–45° high, with a tall trunk sometimes a foot in diameter, small irregularly spreading branches forming a narrow head, and slender glabrous or rarely pilose red-brown branchlets; more often a shrub sometimes with broader obovoid leaves sometimes puberulous on the lower surface.

Dry sandy soil; coast of North Carolina, near Wrightsville, New Hanover County; Dover, near the Ogechee River, Screven County, Georgia; Jacksonville, Duval County, and Panama City on Saint Andrew's Bay, Bay County, Florida; near Selma, Dallas County, Alabama; and Covington, St. Tammany Parish, Louisiana.

A tree only on the shores of Saint Andrew's Bay.

3. CASTANOPSIS Spach.

Trees, with scaly bark, astringent wood, and winter-buds covered by numerous imbricated scales. Leaves convolute in the bud, 5-ranked, coriaceous, entire or dentate, penniveined, persistent; stipules obovate or lanceolate, scarious, mostly caducous. Flowers in 3-flowered cymes, or the pistillate rarely solitary or in pairs, in the axils of minute bracts, on slender erect aments from the axils of leaves of the year; the staminate on usually elongated and panicled aments, and composed of a campanulate 5 or 6-lobed or parted calyx, the lobes inbricated in the bud, usually 10 or 12 stamens inserted on the slightly thickened torus, with elongated exserted filiform filaments and oblong anthers, and a minute hirsute rudimentary ovary; the pistillate on shorter simple or panicled aments or scattered at the base of the staminate inflorescence, the cymes surrounded by an involucre of imbricated scales; calyx urn-shaped, the short limb divided into 6 obtuse lobes; abortive stamens inserted on the limb of the calyx and opposite its lobes; ovary sessile on the thin disk, 3-celled after fecundation, with 3 spreading styles terminating in minute stigmas, and 2 ovules in each cell attached to its interior angle. Fruit maturing at the end of the second or rarely of the first season, its involucre inclosing 1–3 nuts, ovoid or globose, sometimes more or less depressed, rarely obscurely angled, dehiscent or indehiscent, covered by stout spines, tuberculate or marked by interrupted vertical ridges; nut more or less angled by mutual pressure when more than 1, often pilose, crowned with the remnants of the style, marked at the base by a large conspicuous circular depressed scar, the thick shell tomentose on the inner surface. Seed usually solitary by abortion, bearing at apex the abortive ovules; cotyledons plano-convex, fleshy, farinaceous.

Castanopsis inhabits California with two species, and southeastern Asia where it is distributed with about twenty-five species from southern China to the Malay Archipelago and the eastern Himalayas. Of the California species one is usually arborescent and the other *Castanopsis sempervirens* Dudley is a low alpine shrub of the coast ranges and the Sierra Nevada.

Castanopsis, from κάστανα and ὄψις, in allusion to its resemblance to the Chestnut-tree.

1. Castanopsis chrysophylla A. DC. Chinquapin. Golden-leaved Chestnut.

Leaves lanceolate or oblong-ovate, gradually narrowed at the ends or sometimes abruptly contracted at apex into a short broad point, entire with slightly thickened revolute margins, when they unfold thin, coated below with golden yellow persistent scales and above with scattered white scales, at maturity thick and coriaceous, dark green and

lustrous above, 2′–6′ long, ½′ to nearly 2′ wide, with a stout midrib raised and rounded on the upper side; turning yellow at maturity and falling gradually at the end of their second or in their third year; petioles ¼′–⅓′ in length; stipules ovate, rounded or acute at apex, brown and scarious, puberulous, ¼′–⅓′ long. **Flowers** appearing irregularly from June until February in the axils of broadly ovate apiculate pubescent bracts on staminate and androgynous scurfy stout-stemmed aments 2′–2½′ long and crowded at the ends of the branches; calyx of the staminate flower coated on the outer surface with hoary tomentum, divided into broadly ovate rounded lobes much shorter than the slender stamens; calyx of the pistillate flower oblong-campanulate, free from the ovary, clothed with hoary tomentum, divided at apex into short rounded lobes, rather shorter than the minute abortive stamens; anthers red; ovary conic, hirsute, with elongated slightly spreading thick pale stigmas. **Fruit** ripening at the end of the second season, involucre globose, dehiscent, irregularly 4-valved, often slightly shorter than the nuts, sessile, solitary, or clustered, tomentose and covered on the outer surface by long stout or slender rigid spines, 1′–1½′ in diameter, containing 1 or occasionally 2 nuts; nuts broadly ovoid, acute, obtusely 3-angled, light yellow-brown and lustrous; **seeds** dark purple-red, sweet and edible.

Fig. 219

A tree, 50°–100° high, with a massive trunk 3°–6° in diameter, frequently free of branches for 50°, stout spreading branches forming a broad compact round-topped or conic head, and rigid branchlets coated when they first appear with bright golden-yellow scurfy scales, dark reddish brown and slightly scurfy during their first winter, and gradually growing darker in their second season; often much smaller and sometimes reduced to a shrub, 2°–12° high (var. *minor* A. De Candolle). **Winter-buds** fully grown at mid-summer, usually crowded near the end of the branch, ovoid or subglobose, with broadly ovate apiculate thin and papery light brown scales slightly puberulous on the back, ciliate on the scarious often reflexed margins, the terminal about ¼′ long and broad and rather larger than the often stipitate axillary buds. **Bark** 1′–2′ thick and deeply divided into rounded ridges 2′–3′ wide, broken into thick plate-like scales, dark red-brown on the surface and bright red internally. **Wood** light, soft, close-grained, not strong, light brown tinged with red, with thin lighter colored sapwood of 50–60 layers of annual growth; occasionally used in the manufacture of ploughs and other agricultural implements.

Distribution. Skamania County, Washington, valley of the lower Columbia River, Oregon, southward along the western slopes of the Cascade Mountains, and in California along the western slopes of the Sierra Nevada and through the coast ranges to the elevated valleys of the San Jacinto Mountains, sometimes ascending to altitudes of 4000° above the sea; of its largest size in the humid coast valleys of northern California.

Occasionally cultivated in the gardens of temperate Europe.

4. LITHOCARPUS Bl.

Pasania Örst.

Trees, with astringent properties, pubescence of fascicled hairs, deeply furrowed scaly bark, hard close-grained brittle wood, stout branchlets, and winter-buds covered by few erect or spreading foliaceous scales. Leaves convolute in the bud, petiolate, persistent, entire or dentate, with a stout midrib, primary veins running obliquely to the points of the teeth, or on entire leaves forked and united near the margins, and reticulate veinlets; stipules oblong-obovate to linear-lanceolate, those of the upper leaves persistent and surrounding the buds during the winter. Flowers in erect unisexual and in bisexual tomentose aments from the axils of leaves of the year, from the inner scales of the terminal bud or from separate buds in the axils of leaves of the previous year; staminate in 3-flowered clusters in the axils of ovate rounded bracts, the lateral flowers subtended by similar but smaller bracts, each flower composed of a 5-lobed tomentose calyx, with nearly triangular acute lobes, 10 stamens, with slender elongated filaments and small oblong or emarginate anthers, and an acute abortive hairy ovary; pistillate scattered at the base of the upper aments below the staminate flowers, solitary in the axils of acute bracts, furnished with minute lateral bractlets, and composed of a 6-lobed ovoid calyx, with rounded lobes, inclosed in the tomentose involucral scales, 6 stamens, with abortive anthers, an ovoid-oblong 3-celled ovary, 3 elongated spreading light green styles thickened and stigmatic at apex, and 2 anatropous ovules in each cell. Fruit an oval or ovoid nut maturing at the end of the second season, 1-seeded by abortion, surrounded at base by the accrescent woody cupular involucre of the flower, marked by a large pale circular basal scar, the thick shell tomentose on the inner surface. Seed red-brown, filling the cavity of the nut, bearing at apex the abortive ovules; cotyledons thick and fleshy, yellow and bitter.

Lithocarpus is intermediate between the Oaks and the Chestnuts, and, with the exception of one California species, is confined to southeastern Asia, where it is distributed with many species from southern Japan and southern China through the Malay Peninsula to the Indian Archipelago.

Lithocarpus from λίθος and καρπός, in allusion to the character of the fruit.

1. Lithocarpus densiflora Rehd. Tan Bark Oak. Chestnut Oak.

Quercus densiflora Hook. & Arn.

Pasania densiflora Örst.

Leaves oblong or oblong-obovate, rounded or acute or rarely cordate at base, acute or occasionally rounded at apex, or rarely lanceolate and acuminate (f. *lanceolata* Rehdr.) repand-dentate, with acute callous teeth, or entire with thickened revolute margins, coated when they unfold with fulvous tomentum and glandular on the margins with dark caducous glands, at maturity pale green, lustrous and glabrous or covered with scattered pubescence on the upper surface, rusty-tomentose on the lower, ultimately becoming glabrous above and glabrate and bluish white below, 3′–5′ long, ¾′–3′ wide, with a midrib raised and rounded on the upper side, thin or thick primary veins and fine conspicuous reticulate veinlets; persistent until the end of their third or fourth year; petioles stout, rigid, tomentose, ½′–¾′ in length; stipules brown and scarious, hirsute on the outer surface. **Flowers** in early spring and frequently also irregularly during the autumn; aments stout-stemmed, 3′–4′ long; staminate flowers crowded, hoary-tomentose in the bud, their bracts tomentose. **Fruit** solitary or often in pairs, on a stout tomentose peduncle ½′–1′ in length; nut full and rounded at base, gradually narrowed and acute or rounded at apex, scurfy-pubescent when fully grown, becoming light yellow-brown, glabrous and lustrous at maturity, ¾′–1′ long, ½′–1′ thick, its cup shallow, tomentose with lustrous red-brown hairs on the inner surface, and covered by long linear rigid spreading or recurved light brown scales coated with fascicled hairs, frequently tipped, especially while young, with dark red glands and often tomentose near the base of the cup.

A tree, usually 70°–80° but sometimes 150° high, with a trunk 1°–4° in diameter, stout branches ascending in the forest and forming a narrow spire-like head, or in open positions spreading horizontally and forming a broad dense symmetrical round-topped crown, and branchlets coated at first with a thick fulvous tomentum of fascicled hairs often persistent until the second or third year, becoming dark reddish brown and frequently covered with a glaucous bloom; or sometimes reduced to a shrub, with slender stems only a few feet high (var. *montana* Rehdr.). **Winter-buds** ovoid, obtuse, $\frac{1}{4}'$–$\frac{1}{3}'$ long, often surrounded by the persistent stipules of the upper leaves, with tomentose loosely imbricated scales, those of the outer ranks linear-lanceolate, increasing in width toward the interior of the bud, those of the inner ranks ovate or obovate and rounded at apex. **Bark** $\frac{3}{4}'$–$1\frac{1}{2}'$ thick,

Fig. 220

deeply divided by narrow fissures into broad rounded ridges broken into nearly square plates covered by closely appressed light red-brown scales. **Wood** hard, strong, close-grained, brittle, reddish brown, with thick darker brown sapwood; largely used as fuel. The bark is exceedingly rich in tannin and is largely used for tanning leather.

Distribution. Valley of the Umpqua River, Oregon, southward through the coast ranges to the Santa Inez Mountains, California, and along the western slope of the Sierra Nevada up to elevations of 4000° above the sea to Mariposa County; very abundant in the humid coast region north of San Francisco Bay and on the Santa Cruz and Santa Lucia Mountains, and of its largest size in the Redwood forest of Napa and Mendocino Counties; southward and on the Sierras less abundant and of smaller size; the form *lanceolata* in southern Oregon and in Del Norte and Mendocino Counties, California; the var. *montana* at high altitudes on the Siskiyou Mountains, in the region of Mount Shasta and on the northern Sierra Nevada.

5. QUERCUS L. Oak.

Trees or shrubs, with astringent properties, pubescence of fascicled hairs, scaly or dark and furrowed bark, hard and close-grained or porous brittle wood, slender branchlets marked by pale lenticels and more or less prominently 5-angled. Winter-buds clustered at the ends of the branchlets, with numerous membranaceous chestnut-brown slightly accrescent caducous scales closely imbricated in 5 ranks, in falling marking the base of the branchlet with ring-like scars. Leaves 5-ranked, lobed, dentate or entire, often variable on the same branch, membranaceous or coriaceous, the primary veins prominent and extending to the margins or united within them and connected by more or less reticulate veinlets, deciduous in the autumn or persistent until spring or until their third or fourth year;

petioles in falling leaving slightly elevated semiorbicular more or less obcordate leaf-scars broader than high, marked by the ends of numerous scattered fibro-vascular bundles; stipules obovate to lanceolate, scarious, caducous, or those of upper leaves occasionally persistent through the season. Flowers vernal with or after the unfolding of the leaves; staminate solitary in the axils of lanceolate acute caducous bracts, or without bracts, in graceful pendulous clustered aments, from separate or leaf-buds in the axils of leaves of the previous year, or from the axils of the inner scales of the terminal bud or from those of the leaves of the year; calyx campanulate, lobed or divided to the base into 4–7, usually 6, membranaceous lobes; stamens 4–6, rarely 2, or 10–12, inserted on the slightly thickened torus, with free filiform exserted filaments and ovate-oblong or subglobose glabrous or rarely hairy 2-celled usually yellow anthers; pistillate solitary, subtended by a caducous bract and 2 bractlets, in short or elongated few-flowered spikes from the axils of leaves of the year; calyx urn-shaped, with a short campanulate 6-lobed limb, the tube adnate to the incompletely 3 or rarely 4 or 5-celled ovary inclosed more or less completely by an accrescent involucre of imbricated scales, becoming the cup of the fruit; styles as many as the cells of the ovary, short or elongated, erect or incurved, dilated above, stigmatic on the inner face or at apex only, generally persistent on the fruit; ovules anatropous or semianatropous, 2 in each cell. Fruit a nut (*acorn*) maturing in one or in two years, ovoid, subglobose, or turbinate, short-pointed at apex, 1-seeded by abortion, marked at base by a large conspicuous circular scar, with a thick shell, glabrous or coated on the inner surface with pale tomentum, more or less surrounded or inclosed in the accrescent cupular involucre of the flower (*cup*), its scales thin or thickened, loosely or closely imbricated. Seed marked at base or at apex or rarely on the side by the abortive ovules; cotyledons thick and fleshy, usually plano-convex and entire.

Quercus inhabits the temperate regions of the northern hemisphere and high altitudes within the tropics, ranging in the New World southward to the mountains of Colombia and in the Old World to the Indian Archipelago. Two hundred and seventy-five species have been described; of the North American species fifty-four are large or small trees. Of exotic species, the European *Quercus robur* L., and *Quercus sessiliflora* Salisb., have been frequently cultivated as ornamental trees in the eastern United States, where, however, they are usually short-lived and unsatisfactory. Many of the species are important timber-trees; their bark is often rich in tannin and is used for tanning leather, and all produce wood valuable for fuel and in the manufacture of charcoal.

Quercus is the classical name of the Oak-tree.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT SPECIES.

Fruit maturing at the end of the second season (except 22); shell of the nut silky tomentose on the inner surface; leaves or their lobes bristle-tipped. BLACK OAKS.

Stamens usually 4–6; styles elongated, finally recurved; abortive ovules apical.

Leaves deciduous in their first autumn or winter.

Leaves pinnately lobed, convolute in the bud.

Leaves green on both surfaces.

Scales of the cup of the fruit closely appressed.

Leaves usually dull on the upper surface, 7–11-lobed; cup of the fruit cup-shaped or in one variety broad and saucer-shaped, its scales thin.

1. **Q. borealis** (A).

Leaves lustrous.

Leaves dimorphous, 5–7-lobed, axillary clusters of hairs large and prominent; cup of the fruit saucer-shaped or in one form deep cup-shaped.

2. **Q. Shumardii** (A, C).

Leaves similar on upper and lower branches.

Cup of the fruit turbinate or deep cup-shaped.

Leaves 5-lobed, the lobes usually entire, rarely furnished with tufts of axillary hairs below.

3. **Q. texana** (C).

Leaves 5–7-lobed, the lobes dentate, furnished with tufts of axillary hairs below. 4. **Q. ellipsoidalis** (A).

Cup of the fruit deep cup-shaped to turbinate; leaves 5–9-lobed, the lobes toothed. 5. **Q. coccinea** (A, C).

Cup of the fruit saucer-shaped.

Leaves 5–9-lobed. 6. **Q. palustris** (A, C).

Leaves 3–5-lobed. 7. **Q. georgiana** (C).

Scales of the cup of the fruit more or less loosely imbricated, forming a free margin on its rim.

Leaves usually 7-lobed.

Winter-buds tomentose. 8. **Q. velutina** (A, C).

Winter-buds pubescent only at apex. 9. **Q. Kelloggii** (G).

Leaves usually 3–5-lobed; winter-buds rusty pubescent. 10. **Q. Catesbæi** (C).

Leaves whitish or grayish tomentulose below.

Leaves mostly acutely 5-lobed, pale or silvery white below. 11. **Q. ilicifolia** (A).

Leaves often dimorphous, 3–11-lobed, the lobes often falcate. 12. **Q. rubra** (A, C).

Leaves broad-obovate, often abruptly dilated at the wide obscurely lobed apex.

Leaves rounded or cordate at base.

Lower surface of the leaves orange color or brownish, the upper scales of the cup forming with several rows a thick rim on its inner surface, often reflexed. 13. **Q. marilandica** (A, C).

Lower surface of the leaves pale, the erect scales on the rim of the cup in a single row. 14. **Q. arkansana** (C).

Leaves cuneate at base.

Leaves oblong-obovate. 15. **Q. nigra** (C).

Leaves rhombic. 16. **Q. obtusata** (C).

Leaves lanceolate-oblong or lanceolate-obovate, usually entire, involute in the bud. Willow Oaks.

Leaves glabrous.

Leaves lanceolate to oblanceolate, deciduous in autumn. 17. **Q. Phellos** (A, C).

Leaves elliptic or rarely oblong-obovate, deciduous in the late winter. 18. **Q. laurifolia** (C).

Leaves tomentose or pubescent below, oblong-lanceolate to oblong-obovate.

Leaves pale blue-green, hoary tomentose below. 19. **Q. cinerea** (C).

Leaves dark green, pubescent below. 20. **Q. imbricaria** (A).

Leaves not deciduous in the autumn, revolute in the bud (convolute in 23).

Leaves mostly persistent until after the appearance of those of the following year.

Leaves lanceolate, oblong-lanceolate or elliptic, pale and tomentose below. 21. **Q. hypoleuca** (E, H).

Leaves oval, orbicular to oblong, green and pubescent below; fruit maturing at the end of the first season. 22. **Q. agrifolia** (G).

Leaves persistent until their second summer or autumn.

Leaves lanceolate to oval or oblong-lanceolate, entire or serrate; cup of the fruit turbinate or tubular. 23. **Q. Wislizenii** (G).

Leaves oval to oblong-obovate; cup of the fruit saucer-shaped or turbinate. 24. **Q. myrtifolia** (C).

Stamens usually 6–8; styles dilated; abortive ovules basal or lateral; leaves persistent until their third or fourth season, involute in the bud.

Leaves oblong, entire, dentate, or sinuate-toothed, fulvous-tomentose and ultimately pale on the lower surface; cup of the fruit usually thick. 25. **Q. chrysolepis** (G, H).

Leaves oblong-lanceolate, crenate-dentate or entire, pubescent or tomentose below; cup of the fruit usually thin. 26. **Q. tomentella** (G).

Fruit maturing at the end of the first season; shell of the nut glabrous on the inner surface

(hoary-tomentose in 27); abortive ovules basal; stamens 6–8; styles dilated; lobes of the leaves not bristle-tipped. WHITE OAKS.

Leaves mostly persistent until the appearance of those of the following year, revolute in the bud (convolute in 28).

Leaves yellow-green.

Fruit sessile or short-stalked.

Leaves oblong-lanceolate, entire or repand-dentate; inner surface of the nut hoary tomentose. 27. **Q. Emoryi** (F, H).

Leaves oblong or obovate, entire, sinuate-toothed or lobed. 28. **Q. dumosa** (G).

Fruit long-stalked; leaves oblong, elliptic or obovate, pale, glabrous or in one form densely tomentose below. 29. **Q. virginiana** (C).

Leaves blue-green.

Fruit usually in many-fruited long-stalked clusters; leaves broad-obovate, coarsely reticulate-venulose. 30. **Q. reticulata** (H).

Fruit solitary or in pairs.

Cup of the fruit saucer-shaped; leaves ovate to ovate-oblong, entire. 31. **Q. Toumeyi** (H).

Cup of the fruit cup-shaped or hemispherical, oblong-lanceolate to broad-obovate, pubescent below. 32. **Q. arizonica** (H).

Cup of the fruit usually cup-shaped or turbinate.

Leaves ovate, oval or obovate, usually cordate at base; fruit rather long-stalked. 33. **Q. oblongifolia** (E, H).

Leaves oblong to obovate, usually cuneate or rounded or cordate at base. 34. **Q. Engelmannii** (G).

Leaves deciduous in their first season.

Leaves blue-green.

Arboreous; leaves oblong, lobed, spinescent-dentate or entire, pubescent below; cup of the fruit shallow cup-shaped. 35. **Q. Douglasii** (G).

Arborescent or shrubby.

Leaves oblong to oblong-obovate, undulate-lobed; cup of the fruit saucer-shaped to cup-shaped. 36. **Q. Vaseyana** (C).

Leaves oblong-obovate to elliptic or lanceolate, undulate, serrate-toothed or irregularly lobed; cup of the fruit hemispheric to cup-shaped. 37. **Q. Mohriana** (C).

Leaves oblong to oblong-ovate, slightly lobed or entire; cup of the fruit cup-shaped or rarely saucer-shaped. 38. **Q. Laceyi** (C).

Leaves yellow-green.

Leaves entire or slightly lobed.

Leaves different on upper and lower branches, oblong to oblong-obovate, slightly lobed or entire.

Cup of the fruit cup-shaped. 39. **Q. annulata** (C).

Cup of the fruit shallow saucer-shaped. 40. **Q. Durandii** (C).

Leaves similar on upper and lower branches, entire or slightly sinuate-lobed toward the apex, oblong or oblong-obovate. 41. **Q. Chapmanii** (C).

Leaves more or less deeply sinuate-lobed.

Leaves white-tomentulose below (sometimes green and pubescent in 43).

Leaves obovate or oblong, lyrately pinnatifid or deeply sinuate-lobed; cup of the fruit fringed by the awned scales. 42. **Q. macrocarpa** (A, C, F).

Leaves obovate-oblong, deeply 5–9-lobed or pinnatifid; nut often inclosed in the cup. 43. **Q. lyrata** (A, C).

Leaves pubescent below.

Leaves usually covered above with fascicled hairs, obovate, 3–5-lobed, their lobes truncate or rounded. 44. **Q. stellata** (A, C).

Leaves glabrous above at maturity.

Leaves obovate to oblong; cup of the fruit shallow cup-shaped or slightly turbinate, its scales usually thin. 45. **Q. Garryana** (B, G.)

Leaves oblong-obovate; cup of the fruit hemispheric, the scales often much thickened. 46. **Q. utahensis** (F).

Leaves oblong-obovate, deeply lobed; nut conic, elongated, inclosed for one-third its length in the cup-shaped cup. 47. **Q. lobata** (G).

Leaves glabrate or puberulous below, oblong to oblong-obovate. 48. **Q. leptophylla** (F).

Leaves glabrous below.

Leaves oblong-obovate, usually 5-lobed. 49. **Q. austrina** (C).

Leaves oblong-obovate, obliquely pinnatifid or 3–9-lobed. 50. **Q. alba** (A, C).

Leaves coarsely sinuate-toothed. CHESTNUT OAKS.

Fruit on peduncles much longer than the petioles; leaves obovate or oblong-obovate, generally sinuate-dentate or lobed, pubescent, and usually hoary on the lower surface. 51. **Q. bicolor** (C).

Fruit on peduncles about as long or shorter than the petioles.

Leaves obovate or oblong-obovate, cuneate or rounded at the broad or narrow base, tomentose or pubescent and often silvery white below. 52. **Q. Prinus** (A, C).

Leaves obovate or oblong to lanceolate, acuminate, with rounded or acute teeth. 53. **Q. montana** (A, C).

Fruit sessile or nearly so; leaves oblong to lanceolate, acute or acuminate or broadly obovate, puberulous and pale, often silvery white on the lower surface. 54. **Q. Muehlenbergii** (A, C).

1. Quercus borealis Michx. f. Red Oak.

Leaves obovate or oblong, acute or acuminate, abruptly or gradually cuneate or rounded at the broad or narrow base, usually divided about half way to the midrib by

Fig. 221

wide oblique sinuses rounded at the bottom into 11 or sometimes into 7 or 9 acute oblique ovate lobes tapering from broad bases and mostly sinuately 3-toothed at apex with elongated bristle-pointed teeth, or sometimes oblong-obovate, gradually narrowed and cuneate at base, and sinuately lobed with broad acute usually entire or slightly dentate lobes, when they unfold pink, covered with soft silky pale pubescence on the upper surface and

below with thick white tomentum, soon glabrous, at maturity thin and firm, dark green, dull and glabrous above, pale yellow-green, glabrous or rarely puberulous and sometimes furnished with small tufts of rusty hairs in the axils of the veins below, 5′–9′ long, 4′–6′ wide; falling early in the autumn after turning dull or sometimes bright orange color or brown; petioles stout, yellow or red, 1′–2′ in length. **Flowers:** staminate in pubescent aments 4′–5′ long; calyx divided into 4 or 5 narrow ovate rounded lobes shorter than the stamens; pistillate on short glabrous peduncles, their involucral scales broadly ovate, dark reddish brown, shorter than the conspicuous linear acute bract of the flower and as long as the lanceolate acute calyx-lobes; stigmas bright green. **Fruit** solitary or in pairs, sessile or short-stalked, ovoid, gradually narrowed and acute at apex or cylindric and rounded at apex, pale brown, lustrous, more or less tomentose toward the ends, $\frac{1}{2}$′–1′ long; $\frac{1}{2}$′–$\frac{3}{4}$′ in diameter; cup cup-shaped, puberulous on the inner surface, covered with small closely appressed ovate acute red-brown pubescent scales slightly thickened on the back toward the base of the cup, with a thin dark-colored tip and margins.

A tree usually not more than 60°–70° high, with a trunk 2°–3° in diameter, often much smaller, stout branches forming a narrow head, and slender lustrous branchlets light green and covered with pale scurfy pubescence when they first appear, dark red during their first winter and ultimately dark brown. **Winter-buds** ovoid, gradually narrowed to the acute apex, about $\frac{1}{4}$′ long, with thin ovate acute light chestnut-brown scales. **Bark** on young stems and on the upper part of the limbs of old trees 1′–1$\frac{1}{2}$′ thick, dark brown tinged with red and divided into small thick appressed plates scaly on the surface. **Wood** heavy, hard, strong, close-grained, light reddish brown, with thin lighter-colored sapwood; used in construction, for the interior finish of houses, and in furniture.

Distribution. Nova Scotia and New Brunswick, through Quebec to southern Ontario, and southward to northern New England, western New York, northern Pennsylvania (Presque Isle, Erie County), northern Michigan, southeastern Wisconsin, central Minnesota, central Iowa (Winneshick County), and on the Appalachian Mountains of North Carolina at altitudes of about 4000°. Passing with many intermediate forms differing in the size of the nut and in the depth of the cup into

Quercus borealis var. maxima Ashe. Red Oak.

Quercus rubra Du Roi, not L.

Fruit solitary or in pairs, sessile or short-stalked; nut ovoid to slightly obovoid, gradually narrowed and rounded at apex, slightly narrowed at base, usually 1′–1$\frac{1}{4}$′ long and $\frac{1}{2}$′–$\frac{2}{3}$′ thick, occasionally not more than $\frac{2}{3}$′ long and thick, inclosed only at the base in a thick saucer-shaped cup.

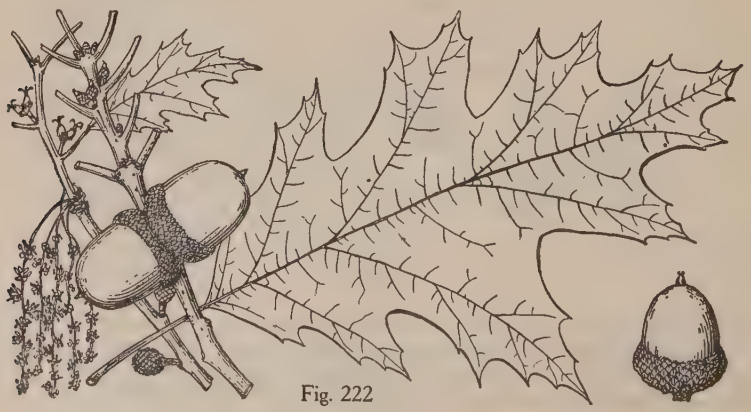

Fig. 222

A tree, usually 70°–80°, or occasionally 150° high, with a trunk 3°–4° in diameter, and stout spreading and ascending branches forming a broad head.

Distribution. Province of Quebec in the neighborhood of Montreal, and southern Ontario, westward through southern Michigan to southeastern Nebraska, and southward to northern Georgia, on the southern Appalachian Mountains up to altitudes of 4000°, southern Kentucky, eastern and central Tennessee, northeastern (Tishomingo County), northwestern (Yazoo County), and central and southern (Hinds and Union Counties) Mississippi, northern and southwestern Alabama (Dekalb, Cullman, Jefferson, and Dallas Counties), northwestern Arkansas, and eastern Kansas and Oklahoma; one of the largest and most generally distributed trees of the northern states; rare and local in the south; of its largest size in the region north of the Potomac and Ohio Rivers.

Often planted as a park and shade tree in the northeastern states and in the counties of western and northern Europe; generally more successful in Europe than other American Oaks.

× *Quercus Lowellii* Sarg., a possible hybrid of *Quercus borealis* and *Q. ilicifolia*, has been found in the neighborhood of Seabury, York County, Maine.

× *Quercus Porteri* Trel., probably a hybrid of *Quercus borealis* var. *maxima* and *Q. velutina*, has been found on Bowditch Hill, Jamaica Plain, Suffolk County, Massachusetts, on College Hill, Easton, Northampton County, Pennsylvania, and near Columbus, Franklin County, Ohio, and Dumas, Clark County, Missouri.

× *Quercus runcinata* Engelm., believed to be a hybrid of *Quercus borealis* var. *maxima* and *Q. imbricaria* first found near St. Louis, occurs also in the neighborhood of Independence, Jackson County, and at Williamsville, Wayne County, Missouri, and in Richland and Wayne Counties, Illinois.

2. Quercus Shumardii Buckl.

Quercus texana Sarg., in part, not Buckl.

Leaves obovate, seven rarely five-lobed, the lobes two or three-lobed and sometimes dentate at apex, on leaves of lower branches short and broad, and separated by narrow sinuses pointed or rounded in the bottom, on upper branches deeply divided by broad rounded sinuses into narrow acuminate lobes, when they unfold often tinged with red and covered with pale loose tomentum deciduous before they are half grown, at maturity glabrous, dark green and lustrous above, paler and furnished below with large axillary tufts

Fig. 223

of pale hairs, 6′–8′ long, 4′–5′ wide, with a thin midrib and slender primary veins running to the points of the lobes; petioles slender, glabrous, 2′–2½′ in length. **Flowers:** staminate in slender glabrous aments 6′–7′ long; calyx divided into 4 or 5 rounded slightly villose lobes shorter than the stamens; pistillate on pubescent peduncles, their involucral scales ovate, light brown, pubescent; stigmas red. **Fruit:** nut oblong-ovoid, narrowed and rounded at apex, ¾′–1¼′ long, ½′–1′ in diameter, inclosed at the base only in the thick saucer-shaped cup with a slightly incurved rim and covered with closely appressed ovate pale pubescent or nearly glabrous scales narrowed above the middle, abruptly long-pointed, thin or often conspicuously tuberculate.

A tree up to 120° high, with a tall trunk occasionally 5° in diameter, stout wide-spreading branches forming a broad rather open head, and gray or grayish brown glabrous branchlets. **Winter-buds** ovoid, acute or acuminate, about ¼′ long, with closely imbricated gray glabrous or rarely pubescent scales. **Bark** 1′–1½′ thick, ridged, broken into small appressed plates scaly on the surface. **Wood** heavy, hard, close-grained, light reddish brown, often manufactured into lumber in the Mississippi valley and considered more valuable than that of the northern Red Oak.

Distribution. Borders of streams and swamps in moist rich soil; coast region of Texas eastward from the Colorado River and ranging inland up the valley of that river to Burnet County, southeastern Oklahoma, through Arkansas, southeastern Kansas and Missouri to Fayette County, Iowa, southern Illinois and Indiana, the neighborhood of Columbus, Franklin County, Ohio, and southeastern Michigan (near Portage Lake, Jackson County); through the eastern Gulf States to western and central Florida and northward in the neighborhood of the coast to the valley of the Neuse River, North Carolina; Chesapeake Beach, Calvert County, Maryland (*W. W. Ashe*); ranging inland in the south Atlantic States to Rome, Floyd County, Georgia, Calhoun Falls, Abbeville County, and Columbia, Richland County, South Carolina, and Chapel Hill, Orange County, North Carolina. Passing into

Quercus Shumardii var. Schneckii Sarg

Quercus texana Sarg. in part, not Buckl.

Quercus Schneckii Britt.

Differing from the type in the deep cup-shaped cup of the fruit covered with thin scales, rarely much thickened and tuberculate at base (only on river banks near Vicksburg,

Fig. 224

Warren County, Mississippi), and connected with it by forms with the cups of the fruit differing from saucer to deep cup-shaped.

Distribution. Growing with *Quercus Shumardii;* more common in Texas and in the Mississippi valley than the type, and ranging eastward through Louisiana and Mississippi to central and southern Alabama, central and southeastern Tennessee (neighborhood of Chattanooga), and central Kentucky, Illinois (Wabash and Pope Counties), Indiana (Wells, Clark, Jennings, Galen, and Posey Counties), and Ohio (Franklin and Gallia Counties); apparently not reaching the Atlantic States.

3. Quercus texana Buckl.

Leaves widest above the middle, broad-cuneate, concave-cuneate or nearly truncate at base, deeply or rarely only slightly divided by broad sinuses rounded in the bottom into 5 or 7 lobes, the terminal lobe 3-lobed and acute at apex, the upper lateral lobes broad and more or less divided at apex and much larger and more deeply lobed than those of the lowest pair, when they unfold densely covered with fascicled hairs and often bright red, soon glabrous, thin, dark green and lustrous above, pale and lustrous and rarely furnished below

Fig. 225

with small inconspicuous axillary tufts of pale hairs, 3′–3½′ long, 2½′–3′ wide, with a thin midrib and slender primary veins running to the points of the lobes; petioles slender, soon glabrous, ¾′–1½′ in length. **Flowers:** staminate in slender villose aments 3′–4′ long; calyx thin, villose on the outer surface, divided into 4 or 5 acute lobes shorter than the stamens; pistillate on short hoary tomentose peduncles, their involucral scales brown tinged with red; stigmas bright red. **Fruit** short-stalked, usually solitary; nut ovoid, narrowed and rounded at apex, light red-brown, often striate, ¼′–¾′ long and broad, sometimes acute, nearly 1′ in length and not more than ½′ in diameter; cup turbinate, covered with thin ovate acuminate slightly appressed glabrous scales, in the small fruit of trees on dry hills inclosing a third or more of the nut, in the larger fruit of trees on better soil comparatively less deep.

A tree on dry hills rarely more than 30° tall, with a trunk 8′–10′ in diameter, small spreading or erect branches and slender red or reddish brown glabrous or rarely pubescent branchlets; often a shrub; on better soil at the foot of hills occasionally 50° high with a trunk 12′–18′ in diameter. **Winter-buds** ovoid, acute, ⅛′–¼′ long and covered with closely imbricated acute slightly or densely pubescent red scales. **Bark** light brown tinged with red, ¾′–1′ thick, deeply ridged and broken into plate-like scales.

Distribution. Dry limestone hills and ridges, and in the more fertile soil at their base; central and western Texas (Dallas, Tarrant County to Travis and Bexar Counties), and to the Edwards Plateau (San Saba, Kerr, Brown, Coke and Uvalde Counties); westward

replaced by the var. *chesosensis* Sarg. differing in the acuminate lobes of the leaves and smaller cups of the fruit; known only on the dry rocky slopes of the Chesos Mountains, Brewster County, Texas; and by the var. *stellapila* Sarg., differing in the presence of fascicled hairs on both surfaces of the mature leaves and on the branchlets of the year; above Fort Davis, Jeff Davis County, Texas.

4. Quercus ellipsoidalis E. J. Hill. Black Oak.

Leaves elliptic to obovate-orbicular, acute or acuminate, truncate or broadly cuneate at base, deeply divided by wide sinuses rounded in the bottom into 5–7 oblong lobes repandly dentate at apex, or often, especially those of the upper pair, repandly lobulate, when they unfold slightly tinged with red and hoary-tomentose, soon becoming glabrous with the exception of small tufts of pale hairs in the axils of the principal veins, at maturity thin and firm, bright green and lustrous above, paler and sometimes entirely glabrous below, 3′–5′ long, 2½′–4′ wide, with a stout midrib and primary veins and prominent reticulate veinlets; late in the autumn turning yellow or pale brown more or less blotched

Fig. 226

with purple; petioles slender, glabrous or rarely puberulous, 1½′–2′ in length. **Flowers:** staminate in puberulous aments 1½′–2′ long; calyx campanulate, usually tinged with red, 2–5-lobed or parted into oblong-ovate or rounded segments, glabrous or slightly villose, fringed at apex with long twisted hairs, about as long as the 2–5 stamens, with short filaments and oblong anthers; pistillate on stout tomentose 1–3-flowered peduncles, red, their involucral scales broad, oblong, acute, hairy; calyx campanulate, 4–7-lobed, ciliate on the margins. **Fruit** short-stalked or nearly sessile, solitary or in pairs; nut ellipsoidal to subglobose, chestnut-brown, often striate and puberulous, inclosed for one third to one half its length in a turbinate or cup-shaped cup gradually narrowed at base, thin, light red-brown, and covered by narrow ovate obtuse or truncate brown pubescent closely appressed scales.

A tree, 60°–70° high, with a short trunk rarely 3° in diameter, much forked branches ascending above and often pendulous low on the stem, forming a narrow oblong head, and slender branchlets covered at first with matted pale hairs, bright reddish brown during their first winter, becoming dark gray-brown or reddish brown in their second season. **Winter-buds** ovoid, obtuse or acute, sometimes slightly angled, about ⅛′ long, with ovate or oval red-brown lustrous slightly puberulous outer scales ciliate on the margins. **Bark** thin, light yellow internally, close, rather smooth, divided by shallow connected fissures into thin plates, dark brown near the base of the tree, dull above, gray-brown and only slightly furrowed on the large branches.

Distribution. In the neighborhood of Chicago, Illinois, to southeastern Minnesota common; often covering large areas of sandy soil with a stunted growth and on the prairies sometimes a low shrub; eastern Iowa (Muscatine County), and the Lower Peninsular of Michigan (Montmorency, Arenac, and St. Clair Counties).

5. Quercus coccinea Muench. Scarlet Oak. Spanish Oak.

Leaves oblong-obovate or elliptic, truncate or cuneate at base, deeply divided by wide sinuses rounded in the bottom into 7 or rarely 9 lobes repand-dentate at apex, the terminal lobe, ovate, acute, and 3-toothed, the middle division the largest and furnished with 2 small lateral teeth, the lateral lobes obovate, oblique or spreading, sometimes falcate, usually broad and oblique at the coarsely toothed apex, when they unfold bright red covered with loose pale pubescence above and below with silvery white tomentum, green at the end of a few days, at maturity thin and firm, bright green, glabrous and very lustrous above, paler and less lustrous and sometimes furnished with small tufts of rusty pubescence in the axils of the veins below, 3′–6′ long, 2½′–4′ broad, with a yellow midrib and primary veins,

Fig. 227

late in the autumn turning brilliant scarlet; petioles slender, terete, 1½′–2½′ in length. **Flowers:** staminate in slender glabrous aments 3′–4′ long; calyx pubescent, bright red before opening, divided into 4 or 5 ovate acute segments shorter than the stamens; pistillate on pubescent peduncles sometimes ½′ long, bright red, their involucral scales ovate, pubescent, shorter than the acute calyx-lobes. **Fruit** sessile or stalked, solitary or in pairs; nut oval, oblong-ovate or hemispheric, truncate or rounded at base, rounded at apex, ½′–1′ long, ⅓′–⅔′ thick, light reddish brown and occasionally striate, inclosed for one third to one half its length in a deep cup-shaped or turbinate thin cup light reddish brown on the inner surface, covered by closely imbricated oblong-ovate acute thin, or rarely much thickened (var. *tuberculata* Sarg.) light reddish brown slightly puberulous scales.

A tree, 70°–80° high, with a trunk 2°–3° in diameter, comparatively small branches spreading gradually and forming a rather narrow open head, and slender branchlets coated at first with loose scurfy pubescence, soon pale green and lustrous, light red or orange-red in their first winter and light or dark brown the following year; usually much smaller. **Winter-buds** ellipsoidal or ovoid, gradually narrowed at apex, ⅛′–¼′ long, dark reddish brown, and pale-pubescent above the middle. **Bark** of young stems and branches smooth, light brown, becoming on old trunks ½′–1′ thick and divided by shallow fissures into irregular ridges covered by small light brown scales slightly tinged with red. **Wood** heavy, hard, strong, coarse-grained, light or reddish brown, with thicker darker colored sapwood.

Distribution. Light dry usually sandy soil; valley of the Androscoggin River, Maine,

southern New Hampshire and Vermont to southern Ontario, southward to the District of Columbia and along the Appalachian Mountains to eastern Kentucky and Tennessee, and northern Georgia; in central Georgia and northeastern Mississippi (near Corinth, Alcorn County), and westward through New York, Ohio, Indiana, Illinois and southern Wisconsin to central Missouri (Jerome, Phelps County); in eastern Oklahoma (Arkansas River valley near Fisher, Creek County, *G. W. Stevens*); ascending to altitudes of nearly 5000° on the southern mountains; the prevailing Oak above 2500° to the summits of the Blue Ridge of the Carolinas; very abundant in the coast region from Massachusetts Bay to southern New Jersey; less common in the interior, growing on dry gravelly uplands, and on the prairies skirting the western margins of the eastern forest. The var. *tuberculata* from southern Massachusetts to Georgia, Alabama, Tennessee, Indiana, southern Illinois, and Missouri.

Occasionally planted in the northeastern states and in Europe as an ornamental tree valued chiefly for the brilliant autumn color of the foliage.

× *Quercus Robbinsii* Trel., believed to be a hybrid of *Quercus coccinea* and *Q. ilicifolia*, occurs at North Easton, Bristol County, Massachusetts.

× *Quercus Benderi* Baenitz, a supposed hybrid of *Quercus coccinea* and *Q. borealis* var. *maxima*, appeared several years ago in Silesia, and a similar tree has been found in the Blue Hills Reservation near Boston.

6. Quercus palustris Muench. Pin Oak. Swamp Spanish Oak.

Leaves obovate, narrowed and cuneate or broad and truncate at base, divided by wide deep sinuses rounded in the bottom into 5–7 lobes, the terminal lobe ovate, acute,

Fig. 228

3-toothed toward the apex, or entire, the lateral lobes spreading or oblique, sometimes falcate, especially those of the lowest pair, gradually tapering and acute at the dentate apex, or obovate and broad at apex, when they unfold light bronze-green stained with red on the margins, lustrous and puberulous above, coated below and on the petioles with pale scurfy pubescence, at maturity thin and firm, dark green and very lustrous above, pale below, with large tufts of pale hairs in the axils of the conspicuous primary veins; 4′–6′ long, 2′–4′ wide, with a stout midrib; late in the autumn gradually turning deep scarlet; petioles slender, yellow, ½′–2′ in length. **Flowers:** staminate in hairy aments 2′–3′ long; calyx puberulous and divided into 4 or 5 oblong rounded segments more or less laciniately cut on the margins, shorter than the stamens; pistillate on short tomentose peduncles, their involucral scales broadly ovate, tomentose, shorter than the acuminate calyx-lobes; stigmas bright red. **Fruit** sessile or short-stalked, solitary or clustered; nut nearly hemispheric,

about $\frac{1}{2}'$ in diameter, light brown, often striate, inclosed only at the base in a thin saucer-shaped cup dark red-brown and lustrous within, and covered by closely appressed ovate light red-brown thin puberulous scales.

A tree, usually 70°–80° high, with a trunk 2°–3° in diameter, often clothed with small tough drooping branches, or when crowded in the forest sometimes 120° high, with a trunk 60°–70° tall and 4°–5° in diameter, slender branches beset with short-ridged spur-like laterals a few inches in length, forming on young trees a broad pyramidal head, becoming on older trees open and irregular, with rigid and more pendulous branches often furnished at first with small drooping branchlets, and slender tough branchlets dark red and covered by short pale silvery tomentum, soon becoming green and glabrous, lustrous dark red-brown or orange color in their first winter, growing darker in their second year and ultimately dark gray-brown. **Winter-buds** ovoid, gradually narrowed and acute at apex, about $\frac{1}{8}'$ long, with imbricated light chestnut-brown scales puberulous toward the thin sometimes ciliate margins. **Bark** of young trunks and branches smooth, lustrous, light brown frequently tinged with red, becoming on older trunks $\frac{3}{4}'$–$1\frac{1}{4}'$ thick, light gray-brown, generally smooth and covered by small closely appressed scales. **Wood** heavy, hard, strong, coarse-grained, light brown, with thin rather darker colored sapwood; sometimes used in construction, and for shingles and clapboards.

Distribution. Borders of swamps and river-bottoms in deep rich moist soil; valley of the Connecticut River in western Massachusetts and Connecticut; on Grand Isle in the Niagara River, New York to southern Ontario and southwestern Michigan, and westward to eastern Iowa (Muscatine County), and southward to southern West Virginia (Hardy and Mercer Counties), southwestern Virginia (Wythe County), central North Carolina (on Bowling's Creek, near Chapel Hill, Orange County, and on Dutchman's Creek, Forsyth County); and to southern Kentucky, central Tennessee, southern Arkansas (Fulton, Hempstead County), and northeastern Oklahoma; rare and of small size in New England; exceedingly common in the green sand belt of New Jersey and Delaware; very abundant on the bottom-lands of the streams of the lower Ohio River.

Often cultivated as an ornamental tree in the northeastern states and occasionally in the countries of western and central Europe.

7. Quercus georgiana M. A. Curtis.

Leaves convolute in the bud, elliptic or obovate, gradually narrowed and cuneate at base, divided generally about half way to the midrib by wide or narrow oblique sinuses

Fig. 229

rounded in the bottom into 3–7 lobes, the terminal lobe ovate, acute, or rounded and entire or frequently furnished with 1 or 2 small lateral teeth, the lateral lobes oblique or

spreading, mostly triangular, acute and entire, or those of the upper and of the middle pair often broad and repand-lobulate at the oblique ends, sometimes gradually 3-lobed at the broad apex and narrowed and entire below, or equally 3-lobed, with broad or narrow spreading lateral lobes, or occasionally pinnatifid, when they unfold bright green tinged with red, ciliate on the margins and coated on the midrib, veins, and petioles with loose pale pubescence, at maturity thin, bright green and lustrous above, paler below, and glabrous or furnished with tufts of hairs in the axils of the primary veins, usually about $2\frac{1}{2}'$ long and $1\frac{1}{2}'$ wide; turning dull orange and scarlet in the autumn; petioles slender, $\frac{1}{2}'$–$\frac{3}{4}'$ in length. **Flowers:** staminate in slender glabrous or pubescent aments 2′–3′ long; calyx divided into 4 or 5 broadly ovate rounded segments rather shorter than the stamens; pistillate on short glabrous slender peduncles; their involucral scales rather shorter than the acute calyx-lobes, pubescent or puberulous; stigmas bright red. **Fruit** short-stalked; nut ellipsoidal or subglobose, $\frac{1}{3}'$–$\frac{1}{2}'$ long, light red-brown and lustrous, inclosed for one third to nearly one half its length in a thick cup-shaped cup light red-brown and lustrous on the inner surface, and covered by thin ovate bright light red-brown truncate erose scales.

Distribution. Georgia; on Stone Mountain, and Little Stone Mountain, Dekalb County; on a few other granite or sandstone hills north and southwest of Stone Mountain (Winder, Jackson County, Rockmart, Polk County and at Warm Springs, Meriwether County).

Occasionally cultivated, and hardy in eastern Massachusetts.

× *Quercus Smallii* Trel., a possible hybrid of *Quercus georgiana* and *Q. marilandica,* occurs on the slopes and summit of Little Stone Mountain, Dekalb County, Georgia.

8. Quercus velutina Lam. Black Oak. Yellow-bark Oak.

Leaves ovate or oblong, rounded, cuneate or truncate at base, mostly 7-lobed and sometimes divided nearly to the middle by wide rounded sinuses into narrow obovate more or less repand-dentate lobes, or into elongated nearly entire mucronate lobes tapering gradually from a broad base, the terminal lobe oblong, elongated, acute, furnished with small lateral teeth, or broad, rounded, and coarsely repand-dentate, or slightly divided into broad dentate lobes or sinuate-dentate, bright crimson when they unfold, and covered above by long loose scattered white hairs and below with thick pale or silvery white tomentum, hoary-pubescent when half grown, and at maturity thick and firm or subcoriaceous, dark green and lustrous above, below yellow-green, brown or dull copper color and more or less pubescent or glabrous with the exception of tufts of rusty hairs in the axils of the principal veins, 3′–12′ long and 2′–10′ wide, but usually 5′–6′ long and 3′–4′ wide, with a stout midrib and primary veins; late in the autumn turning dull red, dark orange color, or brown, and falling gradually during the winter; petioles stout, yellow, glabrous or puberulous, 3′–6′ in length. **Flowers:** staminate in tomentose or pubescent aments 4′–6′ long; calyx coated with pale hairs, with ovate acute lobes; pistillate on short tomentose peduncles, their involucral scales ovate, shorter than the acute calyx-lobes; stigmas bright red. **Fruit** sessile or short-stalked, solitary or in pairs; nut ovoid-oblong, obovoid, oval or hemispheric, broad and rounded at base, full and rounded at apex, light red-brown, often striate, frequently coated with soft rufous pubescence, $\frac{1}{2}'$–$\frac{3}{4}'$ long and broad, or rarely 1′ long and broad, inclosed for about half its length or rarely nearly to the apex in the thin deeply cup-shaped or turbinate cup dark red-brown on the inner surface, covered by thin light chestnut-brown acute hoary scales closely appressed at the base of the cup, loosely imbricated above the middle, with free scarious tips forming a fringe-like border to its rim.

A tree, often 70°–80° and occasionally 150° high, with a trunk 3°–4° in diameter, slender branches spreading gradually into a narrow open head, stout branchlets coated at first with pale or fulvous scurfy tomentum, becoming in their first winter glabrous, dull red or reddish brown, growing dark brown in their second year or brown slightly tinged with red. **Winter-buds** ovoid, strongly angled, gradually narrowed and obtuse at apex, hoary-tomentose, $\frac{1}{4}'$–$\frac{1}{2}'$ long. **Bark** of young stems and branches smooth, dark brown, deep

orange color internally, becoming ¾′–1½′ thick on old trunks, and deeply divided into broad rounded ridges broken on the surface into thick dark brown or nearly black closely appressed plate-like scales. **Wood** heavy, hard, strong, coarse-grained, bright brown tinged with red, with thin lighter colored sapwood; of little value except as fuel. The bark abounds in tannic acid and is largely used in tanning, as a yellow dye, and in medicine.

Distribution. Dry gravelly uplands and ridges; coast of southern Maine to northern Vermont, southern and western Ontario, the southern peninsula of Michigan, northwestern, eastern and southern Iowa, and southeastern Nebraska, and southward to western Florida, southern Alabama, Mississippi, Louisiana, eastern Kansas, northeastern Oklahoma and eastern Texas to the valley of the Brazos River; one of the commonest Oaks on the gravelly drift of southern New England and the middle states: ascending on the southern Appalachian Mountains to altitudes of about 4000°, and often forming a large part of the forest growth on their foothills; abundant in all parts of the Mississippi

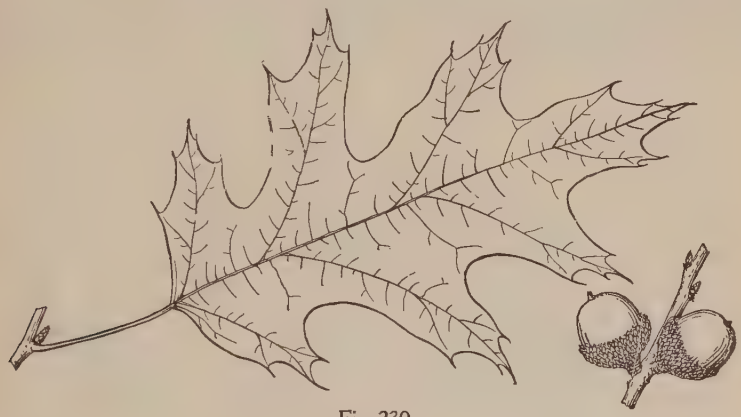

Fig. 230

basin, and of its largest size in the valley of the lower Ohio River; the common species of the Black Oak group reaching the south-Atlantic and Gulf Coast, and here generally scattered on dry ridges through the maritime Pine belt; southward often with a more crooked stem and rougher bark (*R. M. Harper*).

Quercus velutina, which is more variable in the form of its leaves than the other North American Black Oaks, is easily recognized by the bright yellow color of the inner bark, in early spring by the deep red color of the unfolding leaves, becoming pale and silvery in a few days, and by the large tomentose winter-buds. From western Missouri to northwestern Arkansas a form occurs (var. *missouriensis* Sarg.) with the mature leaves covered above with fascicled hairs, and coated below and on the petioles and summer branchlets with rusty pubescence, and with broader more loosely imbricated hoary-tomentose cup-scales.

9. Quercus Kelloggii Newb. Black Oak.

Quercus californica Coop.

Leaves oblong or obovate, truncate, cuneate or rounded at the narrow base, 7 or rarely 5-lobed by wide and deep or shallow and oblique sinuses rounded in the bottom, the terminal lobe ovate, 3-toothed at the acute apex, the lateral lobes tapering gradually from the base or broad and obovate, coarsely repand-dentate with acute pointed teeth, or rarely entire, when they unfold dark red or purple and pilose above and coated below and on the petioles with thick silvery white tomentum, at maturity thick and firm,

lustrous, dark yellow-green and glabrous or rarely pubescent above, light yellow-green or brownish and glabrous or pubescent, or occasionally hoary-tomentose below, 3′–6′ long, 2′–4′ wide; turning yellow or brown in the autumn before falling; petioles slender, yellow, 1′–2′ in length. **Flowers:** staminate in hairy aments 4′–5′ long; calyx pubescent, divided into 4 or 5 ovate acute segments shorter than the stamens; anthers bright red; pistillate on short tomentose peduncles, their involucral scales ovate, coated like the acute calyx-lobes with pale tomentum; stigmas dark red. **Fruit** short-stalked, solitary or clustered; nut oblong, ellipsoidal or obovoid, broad and rounded at base, full and rounded or gradually narrowed and acute at the puberulous apex, 1′–1½′ long, about ¾′ broad, light chestnut-brown, often striate, inclosed for one fourth to two thirds of its length in the deep cup-shaped cup light brown on the inner surface, and covered by thin ovate-lanceolate lustrous light chestnut brown scales, sometimes rounded and thickened on the back toward the base of the cup, their tips elongated, thin and erose on the margins, often forming a narrow fringe-like border to the rim of the cup.

A tree, occasionally 100° high, with a trunk 3°–4° in diameter, stout spreading branches forming an open round-topped head, and branchlets coated at first with thick hoary ca-

Fig. 231

ducous tomentum, bright red or brown tinged with red, and usually glabrous or pubescent or puberulous during their first winter, becoming dark red-brown in their second year; frequently much smaller and at high elevations a small shrub (f. *cibata* Jeps.). **Winter-buds** ovoid, gradually narrowed and acute at apex, about ¼′ long, with closely imbricated pale chestnut-brown scales ciliate on the thin scarious margins and pubescent toward the point of the bud. **Bark** of young stems and branches smooth, light brown, becoming on old trunks 1′–1½′ thick, dark brown slightly tinged with red or nearly black, divided into broad ridges at the base of old trees and broken above into thick irregular oblong plates covered by minute closely appressed scales. **Wood** heavy, hard, strong, very brittle, bright red, with thin lighter colored sapwood; occasionally used as fuel.

Distribution. Valleys and mountain slopes; basin of the Mackenzie River in western Oregon, southward over the California coast ranges, and along the western slopes of the Sierra Nevada up to altitudes of 6500° to the Cuyamaca Mountains near the southern boundary of California; extending across the Sierra Nevada to the foothills of Owens valley (*Jepson*) in eastern California; rare in the immediate neighborhood of the coast; the largest and most abundant Oak-tree of the valleys of southwestern Oregon and of the Sierra Nevada, sometimes forming groves of considerable extent in coniferous forests; of its largest size at altitudes of about 6000° above the sea.

10. Quercus Catesbæi Michx. Turkey Oak.

Leaves oblong or obovate or nearly triangular, gradually narrowed and cuneate at base, deeply divided by wide rounded sinuses into 3 or 5 or rarely 7 lobes, the terminal lobe ovate, elongated, acute and entire or repand-dentate, or obovate and coarsely equally or irregularly 3-toothed at apex, the lateral lobes spreading, usually falcate, entire and acute, tapering from the broad base, and broad, oblique, and repand-lobulate at apex, or 3-toothed at the broad apex and gradually narrowed to the base, coated when they unfold with rufous fascicled hairs, and when fully grown thick and rigid, bright yellow-green and lustrous above, paler, lustrous, and glabrous below, with large tufts of rusty hairs in the axils of the veins, 3′–12′ long, 1′–10′ wide, but usually about 5′ long and wide, with a broad yellow or red-brown midrib; turning bright scarlet before falling in the late autumn or early winter; petioles stout, grooved, $\frac{1}{4}'$–$\frac{3}{4}'$ in length. **Flowers:** staminate in slender hairy red-stemmed aments 4′–5′ long; calyx puberulous and divided into 4 or 5 ovate acute lobes; pistillate on short stout tomentose peduncles, their involucral scales bright red, pubescent, hairy at the margins; stigmas dark red. **Fruit** short-stalked, usually solitary; nut oval, full and rounded at the ends, about 1′ long and $\frac{3}{4}'$ broad, dull light brown,

Fig. 232

covered at the apex by a thin coat of snow-white tomentum, inclosed for about one third its length in a thin turbinate cup often gradually narrowed into a stout stalk-like base, light red-brown and lustrous on the inner surface, covered by ovate-oblong rounded scales extending above the rim of the cup and down over the upper third of the inner surface, and hoary-pubescent except their thin bright red margins.

A tree, usually 20°–30°, or occasionally 50°–60° high, with a trunk rarely exceeding 2° in diameter, stout spreading more or less contorted branches forming a broad or narrow open irregular generally round-topped head, and stout branchlets coated at first with fascicled hairs, nearly glabrous and deep red when the leaves are half grown, dark red in their first winter, gradually growing dark brown; generally much smaller and sometimes shrubby. **Winter-buds** elongated, acute, $\frac{1}{2}'$ long, with light chestnut-brown scales erose on the thin margins, and coated, especially toward the point of the bud, with rusty pubescence. **Bark** $\frac{1}{2}'$–1′ thick, red internally, dark gray tinged with red on the surface, and at the base of old trunks becoming nearly black, deeply and irregularly furrowed and broken into small appressed scales. **Wood** heavy, hard, strong, rather close-grained, light brown tinged with red, with thick lighter colored sapwood; largely used for fuel.

Distribution. Dry barren sandy ridges and sandy bluffs and hummocks in the neighborhood of the coast; southeastern Virginia (near Zuni, Isle of Wight County) to the shores

of Indian River and Peace River, Florida, and westward to eastern Louisiana; comparatively rare toward the western limits of its range, and most abundant and of its largest size on the high bluff-like shores of bays and estuaries in South Carolina and Georgia; the prevailing tree with *Quercus cinerea* in dry sandy uplands of the interior of the Florida peninsula as far south as the sandy ridges in the neighborhood near Fort Ogden, De Soto County; in Georgia inland over the coastal plain to the Pine Mountains, and in Alabama to Tuscaloosa County (*R. M. Harper*).

× *Quercus Mellichampii* Trel. believed to be a hybrid of *Quercus Catesbœi* and *Q. laurifolia* occurs at Bluffton on the coast of South Carolina, in the neighborhood of Orlando, Orange County and near San Mateo, Putnam County, Florida.

× *Quercus Ashei* Trel. believed to be a hybrid of *Quercus Catesbœi* with *Q. cinerea* occurs at Folkston and near Trader's Hill, Charlton County and St. Mary's, Camden County, Georgia.

× *Quercus blufftonensis* Trel., a probable hybrid of *Quercus Catesbœi* and *Q. rubra* L., has been found at Bluffton, South Carolina.

× *Quercus Walteriana* Ashe, believed to be a hybrid of *Quercus Catesbaei* and *Q. nigra*, is not rare in the immediate neighborhood of the coast of South Carolina and Georgia, and occurs on sand hills in Sampson County, North Carolina, near Jacksonville, Duval County, Florida, at Mount Vernon, Mobile County and in the neighborhood of Selma, Dallas County, Alabama.

11. Quercus ilicifolia Wang. Bear Oak. Scrub Oak.

Quercus nana Sarg.

Leaves obovate or rarely oblong, gradually or abruptly cuneate at base, divided by wide shallow sinuses into 3–7, usually 5, acute lobes, the terminal lobe ovate, elongated, rounded and 3-toothed or acute and dentate or entire at apex, the lateral lobes spreading,

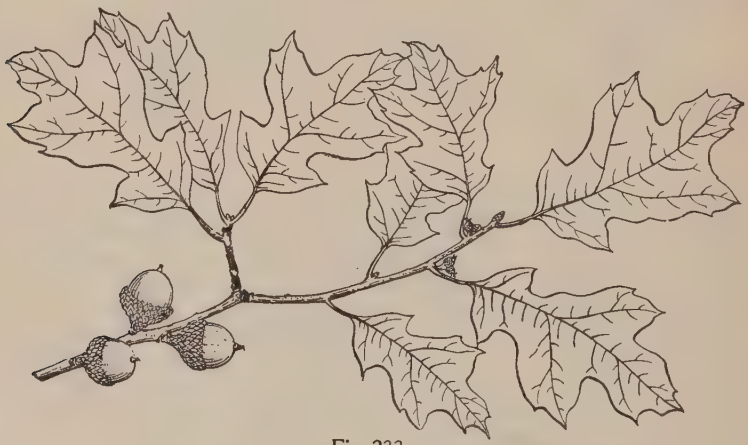

Fig. 233

mostly triangular and acute, or those of the upper pair broad, oblique and repand-lobulate or broad at apex, slightly 3-lobed and entire below, or deeply 3-lobed above and sinuate below, or occasionally oblong to oblong-obovate and entire, with undulate margins, when they unfold dull red and puberulous or pubescent on the upper surface and coated on the lower and on the petioles with thick pale tomentum, with conspicuous tufts of silvery white hairs in the axils of the veins, at maturity thick and firm, dark green and lustrous above, covered below with pale or silvery white pubescence, 2′–5′ long, $1\frac{1}{2}$′–3′ wide,

with a stout yellow midrib and slender primary veins; turning dull scarlet or yellow in the autumn; petioles slender, glabrous, or pubescent, 1′–1½′ in length. **Flowers:** staminate in hairy aments 4′–5′ long, and often persistent until midsummer; calyx red or green tinged with red and irregularly divided into 3–5 ovate rounded lobes shorter than the stamens; anthers bright red ultimately yellow; pistillate on stout tomentose peduncles, their involucral scales ovate, about as long as the acute calyx-lobes, red and tomentose; stigmas dark red. **Fruit** produced in great profusion, sessile or stalked, in pairs or rarely solitary; nut ovoid, broad, flat or rounded at base, gradually narrowed and acute or rounded at apex, about ½′ long and broad, light brown, lustrous, usually faintly striate, inclosed for about one half its length in the cup-shaped or saucer-shaped cup often abruptly enlarged above the stalk-like base, thick, light reddish brown within, and covered by thin ovate closely imbricated red-brown puberulous scales acute or truncate at apex, the minute free tips of the upper scales forming a fringe-like border to the cup.

A tree, occasionally 18°–20° high, with a trunk 5′–6′ in diameter, with slender spreading branches usually forming a round-topped head, and slender branchlets dark green more or less tinged with red and hoary-pubescent at first, during their first winter red-brown or ashy gray and pubescent or puberulous, becoming glabrous and darker in their second year and ultimately dark brown or nearly black; more frequently an intricately branched shrub, with numerous contorted stems 3°–10° tall. **Winter-buds** ovoid, obtuse, about ⅛′ long, with dark chestnut-brown rather loosely imbricated glabrous or pilose scales. **Bark** thin, smooth, dark brown, covered by small closely appressed scales.

Distribution. Dry sandy barrens and rocky hillsides; coast of eastern Maine southward through eastern and southern New England to southern and southwestern Pennsylvania and along the Appalachian Mountains, principally on their eastern slopes, to southern Virginia; on Crowder and King Mountains, Gaston County, North Carolina; and westward to the shores of Lake George and the valley of the Hudson River; common in eastern and southern New Engnlad, in the Pine barrens of New Jersey, and in eastern Pennsylvania.

× *Quercus Brittonii* Davis, believed to be a hybrid of *Quercus ilicifolia* and *Q. marilandica*, has been found on Staten Island, New York, and at Ocean Grove, Monmouth County, New Jersey.

× *Quercus Giffordii* Trel., believed to be a hybrid of *Quercus ilicifolia* and *Q. Phellos*, has been found at May's Landing, Atlantic County, New Jersey.

× *Quercus Rehderi* Trel., believed to be a hybrid of *Quercus ilicifolia* and *Q. velutina*, is not rare in eastern Massachusetts and occurs on Martha's Vineyard (Chilmark).

12. Quercus rubra L. Red Oak. Spanish Oak.

Quercus digitata Sudw.

Leaves ovate to obovate, narrowed and rounded or cuneate at base, the terminal lobe long-acuminate, entire or slightly lobed, often falcate, usually longer than the 2 or 4 acuminate entire lateral lobes narrowed from a broad base and often falcate, or oblong-obovate and divided at the broad apex by wide or narrow sinuses broad and rounded in the bottom into 3 rounded or acute entire or dentate lobes, and entire and gradually narrowed below into an acute or rounded base (var. *triloba* Ashe), the two forms usually occurring on different but sometimes on the same tree, at maturity thin and firm, dark green and lustrous above, coated below with soft close pale or rusty pubescence, 6′–7′ long and 4′–5′ wide, obscurely reticulate-venulose, with a stout tomentose midrib and primary veins; turning brown or dull orange color in the autumn; petioles slender, flattened, 1′–2′ in length. **Flowers:** staminate in tomentose aments, 3′–5′ long; calyx thin and scarious, pubescent on the outer surface, divided into 4 or 5 ovate rounded segments; pistillate on stout tomentose peduncles, their involucral scales coated with rusty tomentum, as long or rather shorter than the acute calyx-lobes; stigmas dark red. **Fruit** sessile or short-stalked; nut subglobose to ellipsoidal, full and rounded at apex, truncate and rounded at base, about

½′ long, bright orange-brown, inclosed only at base or sometimes for one third its length in a thin saucer-shaped cup flat on the bottom or gradually narrowed from a stalk-like base, or deep and turbinate, bright red-brown on the inner surface, covered by thin ovate-oblong reddish scales acute or rounded at apex and pale-pubescent except on the margins.

A tree, usually 70°–80° high, with a trunk 2°–3° in diameter, large spreading branches forming a broad round-topped open head, and stout branchlets coated at first, like the young leaves, with thick rusty or orange-colored clammy tomentum, dark red or reddish brown and pubescent or rarely glabrous during their first winter, becoming in their second year dark red-brown or ashy gray. The var. *triloba* usually 20°–30° rarely 40°–50° high. **Winter-buds** ovoid or oval, acute, ⅛′–¼′ long, with bright chestnut-brown puberulous or pilose scales ciliate with short pale hairs. **Bark** ¾′–1′ thick, dark brown or pale, and divided by shallow fissures into broad ridges covered by thin closely appressed scales. **Wood**

Fig. 234

hard, strong, not durable, coarse-grained, light red, with thick lighter colored sapwood; sometimes used in construction, and largely as fuel. The bark is rich in tannin, and is used in tanning leather and occasionally in medicine.

Distribution. Southeastern and southern Pennsylvania and southern New Jersey southward to central Florida, through the Gulf states to the valley of the Brazos River, Texas, and through eastern Oklahoma, Arkansas, and southeastern Missouri to central Tennessee and Kentucky, southern Indiana and Illinois, southern Ohio (Black Fork Creek, Lawrence County), and Kanawha County, West Virginia; in the north Atlantic states only in the neighborhood of the coast and comparatively rare; very common in the south Atlantic and Gulf states on dry hills between the coast plain and the Appalachian Mountains; less abundant in the southern maritime Pine belt. The var. *triloba:* rare and local. Pleasant Grove, Lancaster County, Pennsylvania, and Jefferson County, Indiana, southward to central and western Florida, southern Alabama and Mississippi, western Arkansas and eastern Texas; on dry uplands near Milledgeville, Baldwin County, Georgia, the prevailing form.

Quercus rubra var. pagodæfolia Ashe. Swamp Spanish Oak. Red Oak.

Quercus pagoda Rafn.

Quercus pagodæfolia Ashe.

Leaves elliptic to oblong, acuminate, gradually narrowed and cuneate or full and rounded or rarely truncate at base, deeply divided by wide sinuses rounded in the bottom into 5–11 acuminate usually entire repand-dentate lobes often falcate and spreading at right angles

to the midrib or pointed toward the apex of the leaf, when they unfold coated with pale tomentum, thickest on the lower surface, and dark red on the upper surface, at maturity dark green and very lustrous above, pale and tomentose below, 6′–8′ long and 5′–6′ wide, with a stout midrib usually puberulous on the upper side, slender primary veins arched to the points of the lobes, and conspicuous reticulate veinlets; turning bright clear yellow before falling; petioles stout, pubescent or tomentose, 1½′–2′ in length. **Flowers** and **Fruit** as in the species.

A tree, sometimes 120° high, with a trunk 4°–5° in diameter, heavy branches forming in the forest a short narrow crown, or in more open situations wide-spreading or ascending and forming a great open head, and slender branchlets hoary tomentose at first, tomentose or pubescent during their first winter, and dark reddish brown and puberulous during their second year. **Winter-buds** ovoid, acute, often prominently 4-angled, about ¼′ long, with

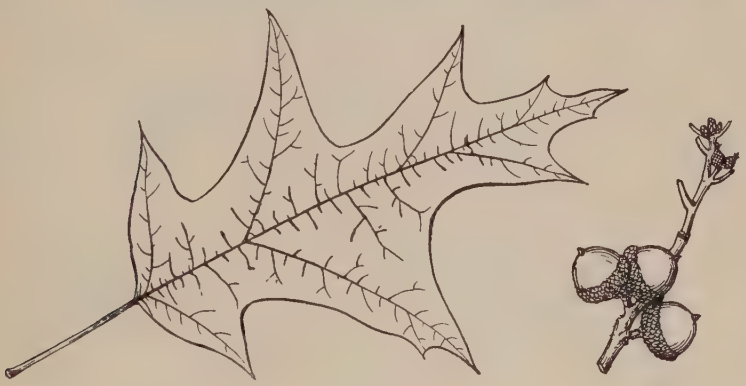

Fig. 235

light red-brown puberulous scales sometimes ciliate at the apex. **Bark** about 1′ thick and roughened by small rather closely appressed plate-like light gray, gray-brown or dark brown scales. **Wood** light reddish brown, with thin nearly white sapwood; largely manufactured into lumber in the Mississippi valley, and valued almost as highly as white oak.

Distribution. Rich bottom-lands and the alluvial banks of streams; Maryland (Queen Anne County) and coast of Virginia to northern Florida, and through the Gulf states and Arkansas to southern Missouri, western Tennessee and Kentucky, and southern Illinois and Indiana; most abundant and one of the largest and most valuable timber-trees in the river swamps of the Yazoo basin, Mississippi, and of eastern Arkansas. Differing chiefly from the type in the more numerous and more acuminate lobes of the usually more elongated leaves usually paler on the lower surface, and in the generally paler bark of the trunk; passing into *Quercus rubra* var. *leucophylla* Ashe with leaves on upper branches nearly as broad as long thickly covered below with brownish pubescence and deeply divided into 5–7 lobes, and on lower branches slightly obovate, less deeply divided, thin, dark green, sometimes pubescent becoming glabrous above and often covered below with pale or brown pubescence.

A tree sometimes 120° high; in low rich soil; coast region of southeastern Virginia, southward to western Florida and through the Gulf states to the valley of the Neches River, Texas, and northward to northern Arkansas; in southern Illinois (near Mt. Carmel, Wabash County) and southwestern Indiana (near Hovey Lake, Posey County); abundant in low woods about River Junction, Gadsden County, Florida, and in central Mississippi.

× *Quercus Willdenoviana* Zabel is believed in Europe to be a hybrid of *Quercus rubra* and *Quercus velutina*.

13. Quercus marilandica Muench. Black Jack. Jack Oak.

Leaves broadly obovate, rounded or cordate at the narrow base, usually 3 or rarely 5-lobed at the broad and often abruptly dilated apex, with short or long, broad or narrow, rounded or acute, entire or dentate lobes, or entire or dentate at apex, sometimes oblong-obovate, undulate-lobed at the broad apex and entire below, or equally 3-lobed with elongated spreading lateral lobes broad and lobulate at apex, when they unfold coated with a clammy tomentum of fascicled hairs and bright pink on the upper surface, at maturity thick and firm or subcoriaceous, dark yellow-green and very lustrous above, yellow, orange color, or brown and scurfy-pubescent below, usually 6′–7′ long and broad, with a thick broad orange-colored midrib; turning brown or yellow in the autumn; petioles stout, yellow, glabrous or pubescent, ½′–¾′ in length. **Flowers:** staminate in hoary aments 2′–4′ long; calyx thin and scarious, tinged with red above the middle, pale-pubescent on the outer surface, divided into 4 or 5 broad ovate rounded lobes; anthers apiculate, dark red; pistillate

Fig. 236

on short rusty-tomentose peduncles coated like their involucral scales with thick rusty tomentum; stigmas dark red. **Fruit,** solitary or in pairs, usually pedunculate; nut oblong, full and rounded at the ends, rather broader below than above the middle, about ¾′ long, light yellow-brown and often striate, the shell lined with dense fulvous tomentum, inclosed for one third to nearly two thirds of its length in a thick turbinate light brown cup puberulous on the inner surface, and covered by large reddish brown loosely imbricated scales often ciliate and coated with loose pale or rusty tomentum, the upper scales smaller, erect, inserted on the top of the cup in several rows, and forming a thick rim round its inner surface, or occasionally reflexed and covering the upper half of the inner surface of the cup.

A tree, 20°–30°, or occasionally 40°–50° high, with a trunk rarely more than 1′ in diameter, short stout spreading often contorted branches forming a narrow compact round-topped or sometimes an open irregular head, and stout branchlets coated at first with thick pale tomentum, light brown and scurfy-pubescent during their first summer, becoming reddish brown and glabrous or puberulous in the winter, and ultimatey brown or ashy gray. **Winter-buds** ovoid or oval, prominently angled, light red-brown, coated with rusty brown hairs, about ¼′ long. **Bark** 1′–1½′ thick, and deeply divided into nearly square plates 1′–3′ long and covered by small closely appressed dark brown or nearly black scales. **Wood** heavy, hard, strong, dark rich brown, with thick lighter colored sapwood; largely used as fuel and in the manufacture of charcoal.

Distribution. Dry sandy or clay barrens: Long Island and Staten Island, New York, eastern and southern Pennsylvania, and southern New Jersey to northern Florida, and westward through the Gulf states to western Texas (Callahan County) and to western

Oklahoma (Dewey and Kiowa Counties), Arkansas, eastern Kansas, southeastern Nebraska and through Missouri to northeastern Illinois, southwestern and southern Indiana, and northeastern Kentucky (South Portsmouth, Greenup County, *R. E. Horsey*); rare in the north, very abundant southward; west of the Mississippi River often forming on sterile soils a great part of the forest growth; of its largest size in southern Arkansas and eastern Texas.

× *Quercus Rudkinii* Britt., with characters intermediate between those of *Quercus marilandica* and *Q. Phellos*, and probably a hybrid of these species, has been found near Tottenville, Staten Island, New York, at Keyport, Monmouth County, New Jersey, and the Falls of the Yadkin River, Stanley County, North Carolina, and Fulton, Hempstead County, Arkansas.

× *Quercus sterilis* Trel., believed to be a hybrid of *Quercus marilandica* and *Q. nigra* has been found in Bladen County, North Carolina.

× *Quercus Hastingsii* Sarg., believed to be a hybrid of *Quercus marilandica* and *Q. texana*, occurs near Boerne, Kendall County, and at Brownwood, Brown County, Texas.

× *Quercus Bushii* Sarg., believed to be a hybrid of *Quercus marilandica* and *Q. velutina*, although not common, occurs in eastern Oklahoma (Sapulpa, Creek County), Arkansas (Fayetteville, Washington County, Eureka Springs, Carroll County), Missouri (Prosperity, Jasper County), Mississippi (Oxford, Lafayette County), Alabama (Dothan, Houston County, near Berlin, banks of the Alabama River near Selma, Dallas County, and Daphne, Baldwin County), Florida (Sumner, Levy County), and in Georgia (Climax, Decatur County).

14. Quercus arkansana Sarg.

Leaves broadly obovate, slightly 3-lobed or dentate at the wide apex, cuneate at base, on sterile branches often oblong-ovate, acute or rounded at apex, rounded at base, the lobes ending in long slender mucros, when they unfold tinged with red, thickly covered with pale fascicled hairs persistent until summer, the midrib and veins more thickly

Fig. 237

clothed with long straight hairs, and at maturity glabrous, with the exception of small axillary tufts of pubescence on the lower surface, light yellow-green above, paler below, 2′–2¾′ long and broad, with a slender light yellow midrib, thin primary veins and prominent veinlets; on sterile branches often 4½′–5½′ long and 2½′–2¾′ wide; petioles slender,

coated at first with clusters of pale hairs, becoming glabrous or puberulous, $\frac{3}{5}'$–$\frac{4}{5}'$ in length. **Flowers:** staminate in aments covered with clusters of long pale hairs, 2′–2½′ long; calyx usually 4 rarely 3-lobed, thinly covered with long white hairs; stamens usually 4; anthers ovoid-oblong, apiculate, dark red; pistillate on stout peduncles hoary-tomentose like the scales of the involucre; stigmas dark red. **Fruit** solitary or in pairs, on short glabrous peduncles; nut broad-ovoid, rounded at apex, sparingly pubescent especially below the middle with fascicled hairs, light brown, obscurely striate, $\frac{1}{4}'$–$\frac{1}{3}'$ long, $\frac{1}{2}'$–$\frac{5}{8}'$ thick, inclosed only at base in the flat saucer-shaped cup, pubescent on the inner surface, covered with closely appressed scales obtuse at their narrow apex, red on the margins, pale pubescent, those of the upper rank smaller, erect, inserted on the top of the cup and forming a thin rim round its inner surface.

A tree when crowded in the forest often 60°–70° high, with a tall trunk, stout ascending branches forming a long narrow head, and slender branchlets thickly coated early in the season with pale fascicled hairs, pubescent or nearly glabrous in their first autumn and darker and glabrous in their second year, when not crowded by other trees rarely 40° high with a short trunk occasionally 1° in diameter. **Winter-buds** ovoid, acute, with thin light chestnut-brown slightly pubescent or nearly glabrous scales. **Bark** thick, nearly black, divided by deep fissures into long narrow ridges covered with thick closely appressed scales.

Distribution. Low woods and on rolling sand hills four miles north of Fulton, Hempstead County, and in Clark County, Arkansas; east to Pike County, Alabama. By Trelease considered a hybrid of *Q. marilandica* and *Q. nigra*. See paper on *Q. arkansana* by Palmer in Jour. Arnold Arb. vi. 195 (1925).

15. Quercus nigra L. Water Oak.

Leaves oblong-obovate, gradually narrowed and cuneate at base and enlarged often abruptly at the broad rounded entire or occasionally 3-lobed apex, on vigorous young branchlets sometimes pinnatifid with acute, acuminate or rounded lobes or broadly oblong-obovate and rounded at apex with entire or undulate margins, on upper branches occasionally linear-lanceolate, on occasional trees narrowed below to an elongated cuneate base and gradually widened above into a more or less deeply 3-lobed apex, the lobes rounded or acute (var. *tridentifera* Sarg.), or often acute at the ends, and on upper branchlets sometimes linear-lanceolate to linear-obovate, acute or rounded at apex, divided above the middle by deep wide rounded sinuses into elongated lanceolate acute entire lobes, or pinnatifid above the middle, when they unfold thin, light green more or less tinged with red and covered by fine caducous pubescence, with conspicuous tufts of pale hairs in the axils of the veins below, at maturity thin, dull bluish green, paler below than above, glabrous or with axillary tufts of rusty hairs, usually about 2½′ long and 1½′ wide, or on fertile branches sometimes 6′ long and 2½′ wide; turning yellow and falling gradually during the winter; petioles stout, flattened, $\frac{1}{8}'$–$\frac{1}{2}'$ in length; leaves of seedling plants linear-lanceolate with entire or undulate margins, or occasionally lobed with 1 or 2 pointed lobes, often deeply 3-lobed at a wide apex, and occasionally furnished below the middle with a single acuminate lobe, all the forms often occurring on a plant less than three feet high. **Flowers:** staminate in red hairy-stemmed aments 2′–3′ long; calyx thin and scarious, covered on the outer surface with short hairs, divided into 4 or 5 ovate rounded segments; pistillate on short tomentose peduncles, their involucral scales a little shorter than the acute calyx-lobes and coated with rusty hairs; stigmas deep red. **Fruit** usually solitary, sessile or short-stalked; nut ovoid, broad and flat at base, full and rounded at the pubescent apex, light yellow-brown, often striate, $\frac{1}{3}'$–$\frac{3}{8}'$ long and nearly as thick, usually inclosed only at the base in a thin saucer-shaped cup, or occasionally for one third its length in a cup-shaped cup, coated on the inner surface with pale silky tomentum and covered by ovate acute closely appressed light red-brown scales clothed with pale pubescence except on their darker colored margins.

A tree, occasionally 80° high, with a trunk 2°–3½° in diameter, numerous slender branches spreading gradually from the stem and forming a symmetrical round-topped

head, and slender glabrous branchlets light or dull red during their first winter, becoming grayish brown in their second season. **Winter-buds** ovoid, acute, strongly angled, covered by loosely imbricated dark red-brown puberulous scales slightly ciliate on the thin margins. **Bark** $\frac{1}{2}'$–$\frac{3}{4}'$ thick, with a smooth light brown surface slightly tinged with red and covered by smooth closely appressed scales. **Wood** heavy, hard, strong, close-grained, light brown, with thick lighter colored sapwood; little valued except as fuel.

Fig. 238

Distribution. High sandy borders of swamps and streams and the rich bottom-lands of rivers, or northward sometimes in dry woods; southern Delaware, southward to the shores of the Indian River and Tampa Bay, Florida, ranging inland in the south Atlantic states through the Piedmont region, and westward through the Gulf states to the valley of the Colorado River, Texas, and through eastern Oklahoma and Arkansas to southeastern Missouri and to central Tennessee and Kentucky. The var. *tridentifera* Sarg. rare and local; southwest Virginia to Alabama (near Selma, Dallas County), central and western Mississippi, eastern Louisiana; valley of Navidad River, Lavaca County, Texas. A form (f. *microcarya* Sarg. — *Quercus microcarya* Small) occurs in the dry soil on slopes of Little Stone Mountain, Dekalb County, Georgia.

The Water Oak is commonly planted as a shade-tree in the streets and squares of the cities and towns of the southern states.

16. Quercus obtusata Ashe.

Quercus rhombica Sarg.

Leaves rhombic, rarely oblong-obovate to lanceolate, acute or rounded and apiculate at apex, cuneate at base, the margins entire or slightly undulate, those on vigorous shoots occasionally furnished on each side near the middle with a short lobe, when they unfold deeply tinged with red, covered with short pale caducous pubescence and furnished below with usually persistent tufts of axillary hairs, at maturity thin, dark green and lustrous above, pale below, $3\frac{1}{2}'$–$4'$ long, $1\frac{1}{2}'$–$2'$ wide, with a stout conspicuous yellow midrib and slender forked primary veins; turning yellow and falling gradually in early winter, rarely at the ends of branches, obovate and rounded, slightly 3-lobed or undulate at the broad apex (var. *obovatifolia* Sarg.); petioles yellow, $\frac{1}{5}'$–$\frac{1}{2}'$ in length. **Flowers** not seen. **Fruit** sessile or short-stalked; nut ovoid, rounded at apex, thickly covered with pale pubescence, $\frac{2}{5}'$–$\frac{1}{2}'$ long, $\frac{3}{5}'$ thick; inclosed only at the base in a saucer-shaped cup, rounded on the bottom, silky pubescent on the inner surface, and covered with slightly pubescent reddish brown loosely appressed scales rounded at apex, with free tips, those of the upper rank thin and ciliate on the margins.

A tree often 120°–150° high, with a tall trunk 3°–$4\frac{1}{2}$° in diameter, stout, wide-spreading

smooth branches forming a broad open head, and slender glabrous branchlets red-brown during their first season and dark gray the following year. **Bark,** pale gray, slightly furrowed and covered with closely appressed scales, $\frac{1}{2}'-\frac{3}{4}'$ thick.

Distribution. Borders of swamps and low wet woods of the coast region; southeastern Virginia (Dismal Swamp) sparingly in Jackson County, west Florida, and through the Gulf states to the valley of the Neches River (Beaumont, Jefferson County), eastern Texas; in

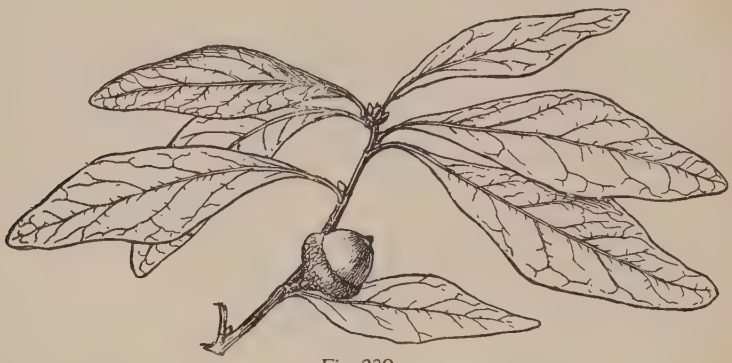

Fig. 239

Louisiana northward to the valley of the Red River; most abundant in south central Alabama and in Louisiana.

× *Quercus beaumontiana* Sarg., believed to be a hybrid of *Quercus obtusata* and *Q. rubra* has been found growing by a street in Beaumont, Jefferson County, Texas.

× *Quercus Cocksii* Sarg., probably a hybrid of *Quercus obtusata* and *Q. velutina,* has been found at Pineville, Rapides Parish, Louisiana.

17. Quercus Phellos L. Willow Oak.

Leaves ovate-lanceolate or rarely obovate-lanceolate, often somewhat falcate, gradually narrowed and acute at the ends, and entire with slightly undulate margins, when they fold light yellow-green and lustrous on the upper surface, coated on the lower with pale

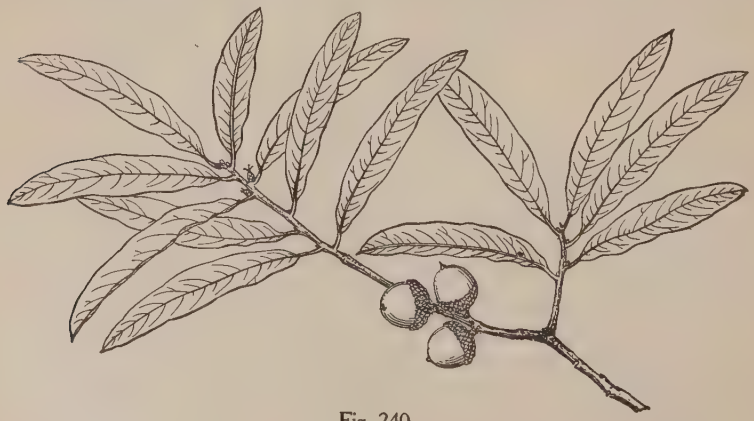

Fig. 240

caducous pubescence, at maturity glabrous, light green and rather lustrous above, dull and paler or rarely hoary-pubescent below, conspicuously reticulate-venulose, 2½′–5′ long, ¼′–1′ wide, with a slender yellow midrib and obscure primary veins forked and united about halfway between the midrib and margins; turning pale yellow in the autumn; petioles stout, about ⅛′ in length. **Flowers:** staminate in slender-stemmed aments 2′–3′ long; calyx yellow, hirsute, with 4 or 5 acute segments; pistillate on slender glabrous peduncles, their involucral scales brown covered by pale hairs, about as long as the acute calyx-lobes; stigmas bright red. **Fruit** short-stalked or nearly sessile, solitary or in pairs; nut hemispheric, light, yellow-brown, coated with pale pubescence, inclosed only at the very base in the thin pale reddish brown saucer-shaped cup silky-pubescent on the inner surface, and covered by thin ovate hoary-pubescent closely appressed scales rounded at apex.

A tree, often 70°–90° high, with a trunk 2° or rarely 4° in diameter, small branches spreading into a comparatively narrow open or conical round-topped head, and slender glabrous reddish brown branchlets roughened by dark lenticels, becoming in their second year dark brown tinged with red or grayish brown; usually much smaller. **Winter-buds** ovoid, acute, about ⅛′ long, with dark chestnut-brown scales pale and scarious on the margins. **Bark** ½′–¾′ thick, light red-brown slightly tinged with red, generally smooth but on old trees broken by shallow narrow fissures into irregular plates covered by small closely appressed scales. **Wood** heavy, strong, not hard, rather coarse-grained, light brown tinged with red, with thin lighter colored sapwood; occasionally used in construction, for clapboards and the fellies of wheels.

Distribution. Low wet borders of swamps and streams and rich sandy uplands; Staten Island, New York, southern New Jersey and southeastern Pennsylvania and southward to western (Jackson County) Florida, through the Gulf states to the valley of the Navasota River, Brazos County, Texas, and through Arkansas, eastern Oklahoma and southeastern Missouri to central Tennessee and northwestern Kentucky (Ballard County), and in southwestern Illinois (Massac and Pope Counties); in the Atlantic states usually confined to the maritime plain; less common in the middle districts, rarely extending to the Appalachian foothills.

Occasionally planted as a shade-tree in the streets of southern towns, and rarely in western Europe; hardy in eastern Massachusetts.

Quercus heterophylla Michx. f.

This has usually been considered a hybrid between *Quercus Phellos* and *Quercus velutina* or *Quercus borealis* var. *maxima*; first known in the eighteenth century from an individ-

Fig. 241

ual growing in a field belonging to John Bartram on the Schuylkill River, Philadelphia. What appears to be the same form has since been discovered in a number of stations from New Jersey to Texas, and it is possible that *Quercus heterophylla* may, as many botanists have believed, best be considered a species.

× *Quercus subfalcata* Trel., believed to be a hybrid of *Quercus Phellos* and *Q. rubra* has been found at Wickliffe, Ballard County, Illinois, at Campbell, Lawrence County, Mississippi, Fulton, Hempstead County, Arkansas, and Houston, Harris County, Texas; its var. *microcarpa* Sarg., probably of the same parentage, originated in a Dutch nursery.

× *Quercus ludoviciana* Sarg., believed to be a hybrid of *Quercus Phellos* and *Q. rubra* var. *pagodæfolia* grows in low wet woods ten miles west of Opelousas, St. Landry Parish, Louisiana.

18. Quercus laurifolia Michx. Laurel Oak. Water Oak.

Leaves elliptic or rarely slightly broadest above the middle, acuminate at the ends, apiculate at apex, occasionally lanceolate or oblong-obovate and rounded at apex (var. *hybrida* Michx.) sometimes 3-lobed at apex, the terminal lobe acuminate, much larger than the others (var. *tridentata* Sarg.), frequently unequally lobed on vigorous branches of

Fig. 242

young trees, with small nearly triangular lobes, when they unfold in spring yellow-green, or later in the season often pink or bright red, and slightly puberulous, at maturity thin, green, and very lustrous above, light green and less lustrous below, usually 3′–4′ long and ¾′ wide, with a conspicuous yellow midrib; many falling gradually in early spring leaving the branches partly bare during only a few weeks; petioles stout, yellow, rarely more than ¼′ in length. **Flowers**: staminate in red-stemmed hairy aments 2′–3′ long; calyx pubescent on the outer surface, divided into 4 ovate rounded lobes; pistillate on stout glabrous peduncles, their involucral scales brown and hairy, about as long as the acute calyx-lobes; stigmas dark red. **Fruit** sessile or subsessile, generally solitary; nut ovoid to hemispheric, broad and slightly rounded at base, full and rounded at the puberulous apex, dark brown, about ½′ long, inclosed for about one fourth its length in a thin saucer-shaped cup red-brown and silky-pubescent on the inner surface, and covered by thin ovate light red-brown scales rounded at apex and pale-pubescent except on their darker colored margins.

A tree, occasionally 100° high, with a tall trunk 3°–4° in diameter, and comparatively slender branches spreading gradually into a broad dense round-topped shapely head, and slender glabrous branchlets dark red when they first appear, dark red-brown during their

first winter, becoming reddish brown or dark gray in their second season. **Winter-buds** broadly ovoid or oval, abruptly narrowed and acute at apex, $\frac{1}{16}'$–$\frac{1}{8}'$ long, with numerous thin closely imbricated bright red-brown scales ciliate on the margins. **Bark** of young trees $\frac{1}{2}'$–$1'$ thick, dark brown more or less tinged with red, roughened by small closely appressed scales, becoming at the base of old trees $1'$–$2'$ thick, nearly black, and divided by deep fissures into broad flat ridges. **Wood** heavy, very strong and hard, coarse-grained, liable to check badly in drying, dark brown tinged with red, with thick lighter colored sapwood; probably used only as fuel.

Distribution. Sandy banks of streams and swamps and rich hummocks in the neighborhood of the coast; North Carolina (near Newbern) southward to the valley of the Caloosahatchee River, Florida, and in the interior of the peninsula to the neighborhood of Lake Istokpoga, De Soto County, and westward to eastern Louisiana, ranging inland to Darlington, Darlington County, South Carolina, to the neighborhood of Augusta, Richmond County, Mayfield, Hancock County, Albany, Dougherty County, Cuthbert, Randolph County, and Bainbridge, Decatur County, Georgia, Georgiana, Butler County, and Berlin, Dallas County, Alabama, Rockport, Copiah County, Mississippi, and to the neighborhood of Bogalusa, Washington Parish, and Kisatchie, Natchitoches Parish, Louisiana (*R. S. Cocks*); nowhere abundant, but most common and of its largest size in eastern Florida.

19. Quercus cinerea Michx. Blue Jack. Upland Willow Oak.

Quercus brevifolia Sarg.

Leaves oblong-lanceolate to oblong-obovate, gradually narrowed and cuneate or sometimes rounded at base, acute or rounded and apiculate at apex, entire with slightly thickened undulate margins, or at the ends of vigorous sterile branches occasionally 3-lobed at

Fig. 243

the apex and variously lobed on the margins (*β dentato-lobata* A. De Candolle), when they unfold bright pink and pubescent on the upper surface, coated on the lower with thick silvery white tomentum, at maturity firm in texture, blue-green, lustrous, conspicuously reticulate venulose above, pale-tomentose below, $2'$–$5'$ long, $\frac{1}{2}'$–$1\frac{1}{2}'$ wide, with a stout yellow midrib and remote obscure primary veins forked and united within the margins; turning red and falling gradually late in the autumn or in early winter; petioles stout, $\frac{1}{4}'$–$\frac{1}{2}'$ in length. **Flowers:** staminate in hoary-tomentose aments $2'$–$3'$ long; calyx pubescent, bright red and furnished at apex with a thick tuft of silvery white hairs before opening, divided into 4 or 5 ovate acute lobes, becoming yellow as it opens; stamens 4 or 5; anthers apiculate, dark red in the bud, becoming yellow; pistillate on short stout tomentose peduncles, their involucral scales about as long as the acute calyx-lobes and coated with

pale tomentum; stigmas dark red. **Fruit** produced in great profusion, sessile or raised on a short stalk rarely $\frac{1}{4}'$ long; nut ovoid, full and rounded at the ends or subglobose, about $\frac{1}{2}'$ long, often striate, hoary-pubescent at apex, inclosed only at the base or for one half its length in a thin saucer-shaped or cup-shaped cup bright red-brown and coated with lustrous pale pubescence on the inner surface, and covered by thin closely imbricated ovate-oblong scales hoary-tomentose except on the dark red-brown margins.

A tree on dry hills, usually 15°–20° high, with a trunk 5′–6′ in diameter, stout branches forming a narrow irregular head, and thick rigid branchlets coated at first with a dense fulvous or hoary tomentum of fascicled hairs, soon becoming glabrous or puberulous, dark brown sometimes tinged with red during their first winter and darker in their second year; or in low moist soil often 60°–75° high, with a trunk 18′–20′ in diameter, and a broad round-topped shapely head of drooping branches. **Winter-buds** ovoid, acute, with numerous rather loosely imbricated bright chestnut-brown scales ciliate on the margins, often $\frac{1}{4}'$ long on vigorous branches, frequently obtuse and occasionally much smaller. **Bark** $\frac{3}{4}'$–$1\frac{1}{2}'$ thick, and divided into thick nearly square plates 1′–2′ long, and covered by small dark brown or nearly black scales slightly tinged with red. **Wood** hard, strong, close-grained, light brown tinged with red, with thick darker colored sapwood; probably only used as fuel.

Distribution. Sandy barrens and dry upland ridges, and in the rich moist soil of the pine-covered flats of the Florida peninsula; North Carolina southward to Fort Myers, Lee County, Florida, and along the Gulf coast to the valley of the Brazos River, Texas; in the Atlantic and middle Gulf states mostly confined to a maritime belt 40°–60° wide, extending across the Florida peninsula as far south as the sand hills in the neighborhood of Lake Istokpoga, De Soto County, and west of the Mississippi River, ranging inland to the neighborhood of Dallas, Dallas County, Texas, and to southeastern Oklahoma (near Antlers, Pushmataha County).

× *Quercus dubia* Ashe, believed to be a hybrid of *Quercus cinerea* and *Q. laurifolia* occurs at Abbottsburg, Bladen County, North Carolina, on the coast of South Carolina, in southern Georgia and northern and central Florida, and at Mississippi City, Harrison County, Mississippi.

× *Quercus subintegra* Trel., a supposed hybrid of *Quercus cinerea* and *Q. rubra* occurs at Lumber City, Telfair County, Georgia, Lake City, Columbia County, Florida, and at Berlin, and near Selma, Dallas County, Alabama.

× *Quercus sublaurifolia* Trel., a supposed hybrid of *Quercus cinerea* and *Q. laurifolia* occurs at Folkston, Charlton County, Georgia, and at Biloxi, Harrison County, Mississippi.

× *Quercus carolinensis* Trel., believed to be a hybrid of *Quercus cinerea* and *Q. marilandica* occurs at Newbern, Craven County, North Carolina, Lumber City, Telfair County and Climax, Decatur County, Georgia, and near Fletcher, Hardin County, Texas.

× *Quercus caduca* Trel., believed to be a hybrid of *Quercus cinerea* and *Q. nigra*, occurs at Folkston, Charlton County and Lumber City, Telfair County, Georgia, Jacksonville, Duval County, and Gainsville, Alachua County, Florida, Mississippi City, Harrison County, Mississippi, and at Milano, Milam County and Bryan, Brazos County, Texas.

× *Quercus oviedoensis* Sarg., believed to be a hybrid of *Quercus cinerea* and *Q. myrtifolia*, has been found near Oviedo, Orange County, Florida.

20. Quercus imbricaria Michx. Shingle Oak. Laurel Oak.

Leaves oblong-lanceolate to oblong-obovate, apiculate and acute or rounded at apex, gradually narrowed and cuneate or rounded at base, entire with slightly thickened, revolute often undulate margins, or sometimes more or less 3-lobed, or on sterile branches occasionally repand-lobulate, when they unfold bright red, soon becoming yellow-green, covered with scurfy rusty pubescence on the upper surface and hoary-tomentose on the lower, at maturity thin, glabrous, dark green, and very lustrous above, pale green or light brown and pubescent below, 4′–6′ long, $\frac{3}{4}'$–2′ wide, with a stout yellow midrib, numerous slender yellow veins arcuate and united at some distance from the margins, and reticulate

veinlets; late in the autumn turning dark red on the upper surface; petioles stout, pubescent, rarely more than ½′ in length. **Flowers:** staminate in hoary-tomentose aments, 2′–3′ long; calyx light yellow, pubescent, and divided into 4 acute segments; pistillate on slender tomentose peduncles, their involucral scales covered with pale pubescence and about as long as the acute calyx-lobes; stigmas greenish yellow. **Fruit** solitary or in pairs, on stout peduncles often nearly ½′ in length; nut nearly as broad as long, full and rounded at the ends, dark chestnut-brown, often obscurely striate, ½′–⅝′ long, inclosed for one third to one half its length in a thin cup-shaped or turbinate cup bright red-brown and lustrous on the inner surface, and covered by thin ovate light red-brown scales rounded or acute at the apex and pubescent except on their darker colored margins.

A tree, usually 50°–60° high, with a trunk rarely exceeding 3° in diameter, or rarely 100° high, with a long naked stem 3°–4° in diameter, slender tough horizontal or somewhat pendulous branches forming a narrow round-topped picturesque head, and slender branch-

Fig. 244

lets dark green, lustrous, and often suffused with red when they first appear, soon glabrous, light reddish brown or light brown during their first winter and dark brown in their second year. **Winter-buds** ovoid, acute, about ⅛′ long, obscurely angled, and covered by closely imbricated light chestnut-brown lustrous scales erose and often ciliate on the margins. **Bark** on young stems and branches thin, light brown, smooth, and lustrous, becoming on old trunks ¾′–1½′ thick, and slightly divided by irregular shallow fissures into broad ridges covered by close slightly appressed light brown scales somewhat tinged with red. **Wood** heavy, hard, rather coarse-grained, light brown tinged with red, with thin lighter colored sapwood; occasionally used in construction, and for clapboards and shingles.

Distribution. Rich hillsides and the fertile bottom-lands of streams; Lehigh County (Allenton to Dorney's Park), Bedford, Huntington, Franklin and Union Counties, Pennsylvania, westward through Ohio to southern Michigan, southern Wisconsin and southeastern and southern Iowa (Muscatine to Taylor County), and southward to the District of Columbia, along the Appalachian Mountains and their foothills, up to altitudes of 2200°, to the valley of the Little Tennessee River, North Carolina, and to northern Georgia (Wilkes County), and middle Tennessee; through Missouri to northeastern Kansas and southeastern Nebraska, and in northern and southern Arkansas (Fulton, Hempstead County); comparatively rare in the east; one of the most abundant Oaks of the lower Ohio basin; probably growing to its largest size in southern Indiana and Illinois.

Occasionally planted as an ornamental tree in the northern states, and hardy as far north as Massachusetts.

Quercus Leana, Nutt., scattered usually in solitary individuals from the District of Columbia and western North Carolina, Bowling Green, Kentucky, to southern Michigan, Illinois and Missouri, is believed to be a hybrid between this species and *Quercus velutina*.

× *Quercus tridentata* Engelm., described as a hybrid of *Quercus imbricaria* and *Q. marilandica* first found at Allenton, Saint Louis County, Missouri, occurs also near Olney, Richland County, Illinois.

× *Quercus exacta* Trel., believed to be a hybrid of *Quercus imbricaria* and *Q. palustris*, occurs near Olney, Richland County, Illinois, and at Crown Point, Lake County, Indiana.

21. Quercus hypoleuca Engelm.

Leaves lanceolate or oblong-lanceolate to elliptic, occasionally somewhat falcate, acute and often apiculate at apex, cuneate or rounded or cordate at the narrow base, entire or repandly serrate above the middle with occasionally small minute rigid spinose teeth,

Fig. 245

or on vigorous shoots serrate-lobed with oblique acute lobes, when they unfold light red, covered with close pale pubescence above and coated below with thick hoary tomentum, at maturity thick and firm, dark yellow-green and lustrous on the upper surface, covered on the lower with thick silvery white or fulvous tomentum, 2′–4′ long, ½′–1′ wide, with thickened revolute margins; turning yellow or brown and falling gradually during the spring after the appearance of the new leaves; petioles stout, flattened, pubescent or tomentose, ⅛′–¼′ in length. **Flowers**: staminate in slender aments 4′–5′ long; calyx slightly tinged with red, covered with pale hairs and divided into 4 or 5 broadly ovate rounded lobes; anthers acute, apiculate, bright red becoming yellow; pistillate mostly solitary, sessile or short-stalked, their involucral scales thin, scarious, and soft-pubescent; stigmas dark red. **Fruit** sessile or borne on a stout peduncle up to ½′ in length, usually solitary; nut ovoid, acute or rounded at the narrow hoary-pubescent apex, dark green and often striate when ripe, becoming light chestnut-brown in drying, ½′–⅔′ long, the shell lined with white tomentum, inclosed for about one third its length in a turbinate thick cup pubescent on the inner surface, and covered by thin broadly ovate light chestnut-brown scales rounded at apex and clothed, especially toward the base of the cup, with soft silvery pubescence.

A tree, usually 20°–30° or sometimes 60° high, with a tall trunk 10′–15′ in diameter, slender branches spreading into a narrow round-topped inversely conic head, and stout rigid branchlets coated at first with thick hoary tomentum disappearing during the first winter, becoming light red-brown often covered with a glaucous bloom and ultimately nearly black; frequently a shrub. **Winter-buds** ovoid, obtuse, about ⅛′ long, with thin

light chestnut-brown scales. **Bark** ¾′–1′ thick, nearly black, deeply divided into broad ridges broken on the surface into thick plate-like scales. **Wood** heavy, very strong, hard, close-grained, dark brown, with thick lighter colored sapwood.

Distribution. Scattered but nowhere abundant through Pine-forests on the slopes of cañons and on high ridges usually at altitudes between 6000°–7000° above the sea on the mountains of western Texas, and of southern New Mexico and Arizona; in northern Chihuahua and Sonora.

22. Quercus agrifolia Née. Live Oak. Encina.

Leaves oval, orbicular or oblong, rounded or acute and apiculate at apex, rounded or cordate at base, entire or sinuate-dentate with slender rigid spinose teeth, when they unfold tinged with red and coated with caducous hoary tomentum, at maturity subcoriaceous, convex, dark or pale green, dull and obscurely reticulate above, paler, rather lus-

Fig. 246

trous, glabrous or pubescent below, with tufts of rusty hairs in the axils of the principal veins, or sometimes covered above with fascicled hairs and coated below with thick hoary pubescence, ¾′–4′ long and ½′–3′ wide, with thickened strongly revolute margins; falling gradually during the winter and early spring; petioles stout or slender, pubescent or glabrous, ½′–1′ in length. **Flowers:** staminate in slender hairy aments 3′–4′ long; calyx bright purple-red in the bud, sometimes furnished with a tuft of long pale hairs at the apex, glabrous or glabrate, divided nearly to the base into 5–7 ovate acute segments reddish above the middle; pistillate sessile or short-stalked, their involucral scales bright red and covered with thick hoary tomentum, or glabrous or puberulous; stigmas bright red. **Fruit** sessile or nearly so, solitary or in few-fruited clusters; nut elongated, ovate, abruptly narrowed at base, gradually narrowed to the acute puberulous apex, light chestnut-brown, ¾′–1½′ long, ¼′–¾′ thick, the shell lined with a thick coat of pale tomentum, inclosed for one third its length or only at the base in a thin turbinate light brown cup coated on the inner surface with soft pale silky pubescence, and covered by thin papery scales rounded at the narrow apex, and slightly puberulous, especially toward the base of the cup.

A tree, occasionally 80°–90° high, with a short trunk 3°–4° or rarely 6°–7° in diameter, dividing a few feet above the base into numerous great limbs often resting on the ground and forming a low round-topped head frequently 150° across, and slender dark gray or brown branchlets tinged with red, coated at first with hoary tomentum persistent until the second or third year; or with a trunk, rising to the height of 30° or 40°, and crowned by a narrow head of small branches; often much smaller; frequently shrubby in habit,

with slender stems only a few feet high. **Winter-buds** globose and usually about $\frac{1}{16}'$ thick, or ovoid-oblong, acute, and sometimes on vigorous shoots nearly $\frac{1}{4}'$ in length, with thin broadly ovate closely imbricated light chestnut-brown glabrous or pubescent scales. **Bark** of young stems and branches thin, close, light brown or pale bluish gray, becoming on old trunks 2′–3′ thick, dark brown slightly tinged with red, and divided into broad rounded ridges separating on the surface into small closely appressed scales. **Wood** heavy, hard, close-grained, very brittle, light brown or reddish brown, with thick darker colored sapwood; valued and largely used for fuel.

Distribution. Usually in open groves of great extent from Sonoma County, California, southward over the coast ranges and islands to the San Pedro Mártir Mountains, Lower California; less common at the north; very abundant and of its largest size in the valleys south of San Francisco Bay and their commonest and characteristic tree; frequently covering with semiprostrate and contorted stems the sand dunes on the coast in the central part of the state; in southwestern California the largest and most generally distributed Oak-tree between the mountains and the sea, often covering low hills and ascending to altitudes of 4500° in the cañons of the San Jacinto Mountains.

Occasionally cultivated as an ornamental tree in temperate western, and in southern Europe.

23. Quercus Wislizenii A. DC. Live Oak.

Leaves narrowly lanceolate to broadly elliptic, generally oblong-lanceolate, acute or rounded and generally apiculate at apex, rounded or truncate or gradually narrowed and cuneate at base, entire, serrulate or serrate or sinuate-dentate with spreading rigid spines-

Fig. 247

cent teeth, when they unfold thin, dark red, ciliate, and covered with pale scattered fascicled hairs, at maturity thick and coriaceous, glabrous and lustrous, dark green on the upper and paler and yellow-green on the lower surface, usually 1′–1½′ long and about ⅔′ wide, with obscure primary veins and conspicuous reticulate veinlets, gradually deciduous during their second summer and autumn; petioles coated at first with hoary tomentum, usually pubescent or puberulous at maturity, ⅛′ to nearly 1′ in length. **Flowers:** staminate in hairy aments 3′–4′ long; calyx tinged with red in the bud, divided into broadly ovate ciliate glabrous light yellow lobes shorter than the 3–6 stamens; pistillate sessile or short-stalked, their involucral scales and peduncle hoary-tomentose. **Fruit** sessile, short-stalked or occasionally spicate; nut slender, oblong, abruptly narrowed at base, pointed and pilose at the apex, ¾′–1½′ long, about ⅓′ thick, light chestnut-brown, often striate, the shell lined with a scanty coat of pale tomentum, more or less inclosed in the thin turbinate sometimes

tubular cup ½′–1′ deep, or rarely cup-shaped and shallow, light green and puberulous within, and covered by oblong lanceolate light brown closely imbricated thin scales, sometimes toward the base of the cup thickened and rounded on the back, usually pubescent or puberulous, especially above the middle, and frequently ciliate on the margins.

A tree, usually 70°–80° high, with a short trunk 4°–6° in diameter, stout spreading branches forming a round-topped head, and slender rigid branchlets coated at first with hoary tomentum or covered with scattered fascicled hairs, puberulous or glabrous and rather light brown during their first season, gradually growing darker in their second year; usually much smaller and sometimes reduced to an intricately branched shrub, with numerous stems only a few feet tall. **Winter-buds** ovoid or oval, acute, ⅛′–¼′ long, with closely imbricated light chestnut-brown ciliate scales. **Bark** on young trees and large branches thin, generally smooth and light-colored, becoming on old trunks 2′–3′ thick, and divided into broad rounded often connected ridges separating on the surface into small thick closely appressed dark brown scales slightly tinged with red. **Wood** heavy, very hard, strong, close-grained, light brown tinged with red, with thick lighter colored sapwood; sometimes used for fuel.

Distribution. Lower slopes of Mt. Shasta southward through the coast region of California to the Santa Lucia Mountains, and to Santa Rosa and Santa Cruz Islands, and along the slopes of the Sierra Nevada to Kern County, up to altitudes of 2000° at the north and of 4500° at the south; as a shrub 4°–6° high with small thick leaves (var. *frutescens* Engelm.) on the desert slopes of the San Bernardino, San Jacinto and Cuyamaca mountains, at altitudes of 5000°–7000° above the sea, and on San Pedro Mártir in Lower California; nowhere common as a tree, but most abundant and of its largest size in the valleys of the coast region of central California at some distance from the sea, and on the foothills of the Sierra Nevada; very common as a shrub in the cañons of the desert slopes of the mountains of southern California; near the coast and on the islands small and mostly shrubby.

× *Quercus morehus*, Kell., a supposed hybrid between *Quercus Wislizenii* and *Q. Kelloggii* occurs in Lake County, also in Placer, Marin, and other counties, California.

24. Quercus myrtifolia Willd.

Leaves oval to oblong-obovate, acute and apiculate or broad and rounded at apex, gradually narrowed and cuneate or broad and rounded or cordate at base, entire, with

Fig. 248

much thickened revolute sometimes undulate margins, or on vigorous shoots sinuate-dentate and lobed above the middle, when they unfold, thin, dark red, coated below and on the

petioles with clammy rusty tomentum and densely pubescent above, at maturity thick and coriaceous, lustrous, dark green, glabrous and conspicuously reticulate-venulose above, paler, yellow-green, or light orange-brown, glabrous or pubescent below, with tufts of rusty hairs in the axils of the veins, $\frac{1}{2}'$–$2'$ long and $\frac{1}{4}'$–$1'$ wide; falling gradually during their second year; petioles stout, pubescent, yellow, rarely more than $\frac{1}{3}'$ in length. **Flowers:** staminate in hoary pubescent aments $1'$–$1\frac{1}{2}'$ long; calyx coated on the outer surface with rusty hairs and divided into 5 ovate acute segments shorter than the 2 or 3 stamens; pistillate sessile or nearly sessile, solitary or in pairs, their involucral scales tomentose and tinged with red. **Fruit** solitary or in pairs, sessile or short-stalked; nut subglobose or ovoid, acute, $\frac{1}{4}'$–$\frac{1}{2}'$ long, dark brown, lustrous and often striate, puberulous at apex, the shell lined with a thick coat of rusty tomentum, inclosed for one fourth to one third its length in a saucer-shaped or turbinate cup light brown and puberulous within, and covered by closely imbricated broad-ovate light brown pubescent scales ciliate on the margins and rounded at their broad apex.

A round-topped tree, rarely 40° high, with a trunk $4'$–$5'$ or rarely up to $15'$ in diameter, short or rarely long spreading branches and slender branchlets coated at first with a thick pale fulvous tomentum of articulate hairs usually persistent during the summer, light brown more or less tinged with red or dark gray, and pubescent or puberulous during their first winter, becoming darker and glabrous in their second season; more often an intricately branched shrub, with slender rigid stems 3°–4° or rarely 15°–20° high and $1'$–$3'$ in diameter. **Winter-buds** ovoid or oval, gradually narrowed to the acute apex, with closely imbricated dark chestnut-brown slightly puberulous scales. **Bark** thin and smooth, becoming near the ground dark and slightly furrowed.

Distribution. Dry sandy ridges on the coast and islands of South Carolina to Bay Biscayne, Florida, crossing the central peninsula and from the valley of the Caloosahatchee River, westward along the coast of Florida, Alabama, and Mississippi; most abundant on the islands off the coast of east Florida, and of Alabama and Mississippi; often covering large areas with low impenetrable thickets; perhaps of its largest size in Orange County, on Jupiter Island, and on the coast west of the Apalachicola River, Florida.

25. Quercus chrysolepis Liebm. Live Oak. Maul Oak.

Leaves oblong-ovate to elliptic, acute or cuspidate at apex, cordate, rounded or cuneate at base, mostly entire on old trees, often dentate or sinuate-dentate on young trees with

Fig. 249

1 or 2 or many spinescent teeth, the two forms often appearing together on vigorous shoots, clothed when they unfold with a thick tomentum of fulvous hairs soon deciduous from the

upper and more gradually from the lower surface, at maturity thick and coriaceous, bright yellow-green and glabrous above, more or less fulvous-tomentose below during their first year, ultimately becoming glabrate and bluish white, 1′–4′ long, ½′–2′ wide, with thickened revolute margins; deciduous during their third and fourth years; petioles slender, yellow, rarely ½′ in length. **Flowers:** staminate in slender tomentose aments 2′–4′ long; calyx light yellow, pubescent, divided usually into 5–7 broadly ovate acute ciliate lobes often tinged with red above the middle; pistillate sessile or subsessile or rarely in short few-flowered spikes, their broadly ovate involucral scales coated with fulvous tomentum; stigmas bright red. **Fruit** usually solitary, sessile or short-stalked; nut ellipsoidal or ovoid, acute or rounded at the full or narrow slightly puberulous apex, light chestnut-brown, ½′–2′ long and about as thick, the shell lined with a thin coat of loose tomentum, with abortive ovules scattered irregularly over the side of the seed, inclosed only at the base in a thin hemispheric or in a thick turbinate broad-rimmed cup pale green or dark reddish brown within, and covered by small triangular closely appressed scales with a short free tip, clothed with hoary pubescence, or often hidden in a dense coat of fulvous tomentum.

A tree, usually not more than 40°–50° high, with a short trunk 3°–5° in diameter, dividing into great horizontal limbs sometimes forming a head 150° across, and slender rigid or flexible branchlets coated at first with thick fulvous tomentum, becoming during their first winter dark brown somewhat tinged with red, tomentose, pubescent, or glabrous, and ultimately light brown or ashy gray; occasionally in sheltered cañons producing trunks 8°–9° in diameter; on exposed mountain sides forming dense thickets 15°–20° high. **Winter-buds** broadly ovoid or oval, acute, about ⅛′ long, with closely imbricated light chestnut-brown usually puberulous scales. **Bark** ¾′–1½′ thick, light or dark gray-brown tinged with red, and covered by small closely appressed scales. **Wood** heavy, very strong, hard, tough, close-grained, light brown, with thick darker colored sapwood; used in the manufacture of agricultural implements and wagons.

Distribution. Southern Oregon, along the California coast ranges and the western slopes of the Sierra Nevada to the San Bernardino and San Jacinto mountains; of its largest size in the cañons of the coast ranges of central California and on the foothills of the Sierra Nevada; ascending to altitudes of 8000°–9000° above the sea; near the southern boundary of California, on the mountains of northern Lower California and Sonora and in Arizona (Santa Rita and Huachuca Mountains, on Beaver Creek and in Copper Cañon near Camp Verde, and in Sycamore Cañon south of Flagstaff), usually shrubby, with rigid branches, rigid coriaceous oblong or semiorbicular spinose-dentate leaves, subsessile or pedunculate fruit, with ovoid acute nuts 1′–1½′ long, their shells lined with thick or thin pale tomentum, and purple cotyledons (var. *Palmeri* Engelm. — *Quercus Wilcoxii* Rydb.)

26. Quercus tomentella Engelm.

Leaves oblong-lanceolate, acute, sometimes cuspidate or occasionally rounded at apex, broad and rounded or gradually narrowed and abruptly cuneate at base, remotely crenate-dentate with small remote spreading callous tipped teeth, or entire, when they unfold light green tinged with red, covered above with scattered pale fascicled hairs and below and on the petioles with thick hoary tomentum, at maturity thick and coriaceous, dark green, glabrous and lustrous on the upper surface, pale and covered with fascicled hairs on the lower surface, 2′–4′ long, 1′–2′ wide, with thickened strongly revolute margins, and a pubescent midrib; gradually deciduous during their third season; petioles stout, pubescent, about ½′ in length. **Flowers:** staminate in pubescent aments 2½′–14′ long, calyx light yellow, pubescent, divided into 5–7 ovate acute lobes; pistillate subsessile or in few-flowered spikes on short or elongated pubescent peduncles, their involucral scales like the calyx coated with fascicled hairs; stigmas red. **Fruit** subsessile or short-stalked; nut ovoid, broad at base, full and rounded at apex, about 1½′ long and ¾′ thick, inclosed only at the base in a cup-shaped shallow cup thickened below, light brown and pubescent on the inner surface, and covered by thin ovate acute scales, their free chestnut-brown tips more or less hidden in a thick coat of hoary tomentum.

A tree, 30°–40°, or occasionally 60° high, with a trunk 1°–2° in diameter, spreading branches forming a shapely round-topped head, and slender branchlets coated at first with hoary tomentum, becoming light brown tinged with red or orange color. Winter-buds ovoid, acute or obtuse, nearly $\frac{1}{4}'$ long, with many loosely imbricated light chestnut-brown

Fig. 250

scales more or less clothed with pale pubescence. Bark thin, reddish brown, broken into large closely appressed scales. Wood heavy, hard, close-grained, compact, pale yellow-brown, with lighter colored sapwood.

Distribution. Deep narrow cañons and high wind-swept slopes of Santa Rosa, Santa Cruz, and Santa Catalina islands, California; on Guadalupe Island off the coast of Lower California.

27. Quercus Emoryi Torr. Black Oak.

Leaves oblong-lanceolate, acute and mucronate at apex, cordate or rounded at the slightly narrowed base, entire or remotely repand-serrate with 1–5 pairs of acute rigid oblique teeth, when they unfold thin, light green more or less tinged with red and covered with silvery white tomentum, at maturity thick, rigid, coriaceous, dark green, very lustrous and glabrous or coated above with minute fascicled hairs, pale and glabrous or puberulous below, usually with 2 large tufts of white hairs at the base of the slender midrib, obscurely reticulate-venulose, $1'$–$2\frac{1}{2}'$ long, $\frac{1}{2}'$–$1'$ wide; falling gradually in April with the appearance of the new leaves; petioles stout, pubescent, about $\frac{1}{4}'$ in length. Flowers: staminate in hoary tomentose aments; calyx light yellow, hairy on the outer surface, divided into 5–7 ovate acute lobes; pistillate sessile or short-stalked, their involucral scales covered with hoary tomentum. Fruit ripening irregularly from June to September, sessile or short-stalked; nut oblong, oval, or ovate, narrowed at base, rounded at the narrow pilose apex, $\frac{1}{2}'$–$\frac{3}{4}'$ long, about $\frac{1}{3}'$ thick, dull light green when fully grown, dark chestnut-brown or nearly black at maturity, with a thin shell lined with thick white tomentum, inclosed for from one third to one half its length in the deeply cup-shaped or nearly hemispheric cup light green and pubescent within, and covered by closely imbricated broadly ovate acute thin and scarious light brown scales clothed with short soft pale pubescence.

A tree, usually 30°–40° high, with a short trunk 2°–3° in diameter, stout rigid rather drooping branches forming a round-topped symmetrical head, and slender rigid branchlets covered at first with close hoary tomentum, bright red, pubescent or tomentose in their first winter, ultimately glabrous and dark red-brown or black; sometimes 60°–70° high, with a trunk 4°–5° in diameter, with a head occasionally 100° across; or at high alti-

tudes or on exposed mountain slopes a low shrub. **Winter-buds** ellipsoidal, acute, about $\frac{1}{4}'$ long, pale pubescent toward the apex, with thin closely imbricated light chestnut-brown ciliate scales. **Bark** 1′–2′ thick, dark brown or nearly black, deeply divided into large oblong thick plates separating into small thin closely appressed scales. **Wood** heavy, strong, brittle, close-grained, dark brown or almost black, with thick bright brown sapwood tinged with red. The sweet acorns are an important article of food for Mexicans and Indians, and are sold in the towns of southern Arizona and northern Mexico.

Fig. 251

Distribution. Mountain ranges of western Texas, southern New Mexico, Arizona south of the Colorado plateau, and of northern Mexico; in Texas common in the cañons and on the southern slopes of the Limpio and Chisos mountains; the most abundant Oak of southern New Mexico and Arizona, forming a large part of the forests covering the mountain slopes and extending from the upper limits of the mesa nearly to the highest ridges; attaining its largest size and beauty in the moist soil of sheltered cañons.

28. Quercus dumosa Nutt. Scrub Oak.

Leaves oblong, rounded and acute at apex, broad and abruptly cuneate or rounded at base, usually about $\frac{3}{4}'$ long and $\frac{1}{2}'$ wide, spinescent with a few minute teeth, or undulate and entire or coarsely spinescent, with an obscure midrib and primary veins, conspicuous reticulate veinlets, and stout petioles rarely $\frac{1}{8}'$ long; or sometimes oblong to oblong-obovate and divided by deep sinuses into 5–9 oblong acute rounded or emarginate bristle-tipped lobes, the terminal lobe 3-lobed, rounded or acute, 2′–4′ long and 1′–$1\frac{1}{2}'$ wide, with primary veins running to the points of the lobes, obscure reticulate veinlets, and petioles sometimes 1′ long, thin when they unfold and clothed with scattered fascicled hairs, or rarely tomentose above and coated below and on the petioles with hoary tomentum, at maturity thick and firm, dark green and glabrous on the upper surface, paler and more or less pubescent on the lower surface; mostly deciduous during the winter. **Flowers:** staminate in pubescent aments; calyx divided into 4–7 ovate lanceolate hairy segments; pistillate sessile or stalked, in long many-flowered tomentose spikes, their involucral scales and calyx hoary-tomentose; stigmas red. **Fruit** sessile or short-stalked; nut ovoid, broad at base, broad and rounded or acute at apex, $\frac{1}{2}'$–1′ long, $\frac{1}{3}'$–$\frac{2}{3}'$ thick, inclosed for one half to two thirds its length in a deep cup-shaped or hemispheric cup light brown and pubescent within, covered by ovate pointed scales coated with pale or rufous tomentum, usually much thickened, united and tuberculate, those above with free acute tips forming a fringe to the rim of the cup, or frequently with basal scales but little thickened and furnished with long free tips; in var. *Alvordiana* Jeps., with a nut $1\frac{1}{2}'$–$1\frac{5}{8}'$ long, $\frac{1}{4}'$–$\frac{1}{2}'$ thick, gradually narrowed and acute at apex, inclosed only at base in a shallow cup-shaped cup.

A tree, rarely 20° high, with a trunk 12′–18′ in diameter, small branches forming a round-topped head, and slender branchlets coated at first with hoary tomentum, becoming in their first winter ashy gray or light or dark reddish brown and usually pubescent or tomentose; more often an intricately branched rigid shrub, with stout stems covered by

Fig. 252

pale gray bark and usually 6°–8° high, often forming dense thickets. **Winter-buds** ellipsoidal, generally acute, $\frac{1}{16}'$–$\frac{1}{8}'$ long, with thin pale red often pilose and ciliate scales. **Bark** of the trunk bright brown and scaly.

Distribution. California; western slopes of the central Sierra Nevada; common on the coast ranges south of San Francisco Bay and on the islands off the coast of the southern part of the state, ranging inland to the borders of the Mohave Desert and to the cañons of the desert slopes of the San Bernardino and San Jacinto mountains, and southward into Lower California; arborescent only in sheltered cañons of the islands; the var. *Alvordiana*, in the San Emidio Cañon of the coast ranges of Kern County and on the San Carlos Range, Fresno County; north of San Francisco Bay replaced by the variety *bullata* Engelm. ranging to Mendocino County and to Napa valley.

× *Quercus MacDonaldii* Greene, a shrub or small tree with characters intermediate between those of *Quercus dumosa* and *Q. Engelmannii*, is usually considered a hybrid of these species. It occurs on Santa Cruz and Santa Catalina Islands, and in Santa Barbara, and Los Angeles Counties, California.

29. Quercus virginiana Mill. Live Oak.

Leaves oblong, elliptic or obovate, rounded or acute at apex, gradually narrowed and cuneate or rarely rounded or cordate at base, usually entire with slightly revolute margins, or rarely spinose-dentate above the middle, thin, dark green and lustrous on the upper surface, pale and pubescent on the lower surface, 2′–5′ long, $\frac{1}{2}'$–$2\frac{1}{2}'$ wide, and inconspicuously reticulate-venulose, with a narrow yellow midrib, and few slender obscure primary veins forked and united at some distance from the margins; gradually turning yellow or brown at the end of the winter and falling with the appearance of the new leaves in the spring; petioles stout, rarely more than $\frac{1}{4}'$ in length. **Flowers:** staminate in hairy aments 2′–3′ long; calyx light yellow, hairy, divided into 5–7 ovate rounded segments; anthers hirsute; pistillate in spikes on slender pubescent peduncles 1′–3′ long, their involucral scales and ovate calyx-lobes coated with hoary pubescence; stigmas bright red. **Fruit** usually in 3–5 fruited spikes or rarely in pairs or single on stout light brown puberulous peduncles 1′–5′ long; nut ellipsoidal or slightly obovoid, narrowed at base, rounded or acute at apex, dark chestnut-brown and lustrous, about 1′ long and $\frac{1}{3}'$ thick, inclosed for about one fourth its length in a turbinate light reddish brown cup puberulous within,

its scales thin, ovate, acute, slightly keeled on the back, covered by dense lustrous hoary tomentum and ending in small closely appressed reddish tips; **seed** sweet, with light yellow connate cotyledons.

A tree, 40°–50° high, with a trunk 3°–4° in diameter above its swollen buttressed base, usually dividing a few feet from the ground into 3 or 4 horizontal wide-spreading limbs forming a low dense round-topped head sometimes 130° across, and slender rigid branchlets coated at first with hoary tomentum, becoming ashy gray or light brown and pubescent or puberulous during their first winter and darker and glabrous the following season; occasionally 60°–70° tall, with a trunk 6°–7° in diameter; often shrubby and occasionally not more than a foot high. **Winter-buds** globose or slightly obovoid, about $\frac{1}{6}'$ long, with thin light chestnut-brown scales white and scarious on the margins. **Bark** of the trunk and large branches $\frac{1}{2}'$–$1'$ thick, dark brown tinged with red, slightly furrowed, separating on

Fig. 253

the surface into small closely appressed scales. **Wood** very heavy, hard, strong, tough, close-grained, light brown or yellow, with thin nearly white sapwood; formerly largely and still occasionally used in shipbuilding.

Distribution. Shores of Mobjack Bay, Virginia, southward along the coast and islands to southern Florida, and along the shores of the Gulf of Mexico to northeastern Mexico, spreading inland through Texas to the valley of the Red River and to the mountains in the extreme western part of the state; on the mountains of Cuba, southern Mexico, and Central America; most abundant and of its largest size on the Atlantic and east Gulf coasts on rich hummocks and ridges a few feet above the level of the sea; abundant in Texas in the coast region, near the banks of streams, and westward toward the valley of the Rio Grande often forming the principal part of the shrubby growth on low moist soil; in sandy barren soil in the immediate vicinity of the seacoast or on the shores of salt water estuaries and bays often a shrub, sometimes bearing fruit on stems not more than a foot high (var. *maritima*, Sarg., and var. *dentata* Sarg.).

Occasionally planted as a shade and ornamental tree in the southern United States.

Variable in habit and in the size and thickness of the leaves the different forms of *Quercus virginiana* show little variation in their fruit. The most important of these varieties is

Quercus virginiana var. geminata Sarg.

Quercus geminata Small.

Leaves oblong-obovate to elliptic, rounded or acute at apex, cuneate or narrowed and rounded at base, occasionally slightly and irregularly dentate above the middle on vigorous shoots, conspicuously reticulate-venulose, hoary tomentose below, $1\frac{1}{2}'$–$3'$ long, $\frac{1}{3}'$–$1'$

wide, with thickened strongly revolute margins; persistent until after the leaves of the typical *Q. virginiana* in the same locality have all fallen; occasionally in Florida with oblong-elliptic to slightly obovate leaves 4½′–5′ long and 1′–2′ wide (f. *grandifolia* Sarg.). **Flowers** and **Fruit** as in the species.

A tree often 75° high with a trunk 3° in diameter, with the habit, branchlets, winter-buds and bark of the typical form; often much smaller and occasionally a shrub.

Distribution. Sandy soil; coast region of North Carolina south of the Cape Fear River, South Carolina and Georgia, and southward in Florida to Jupiter Island on the east coast and the valley of the Caloosahatchee River on the west coast; abundant and often the common Live Oak in the central part of the peninsula, at least as far south as Orange County, and westward through western Florida, southeastern and southern Alabama to the Gulf coast and islands of Mississippi.

Fig. 254

Other varieties of *Quercus virginiana* are var. *macrophylla* Sarg., differing from the type in its much larger ovate or slightly obovate leaves rounded or acute at base, entire or occasionally repand-dentate, pale tomentose below, 3½′–4′ long and 1¼′–2½′ wide. Large trees forming groves; sandy bottoms of the Atascosa River and in flat woods above them, Pleasanton, Atascosa County, Texas: var. *virescens* Sarg., differing from the type in the green glabrous or rarely puberulous lower surface of the leaves and in the glabrous branchlets. A large tree in sandy soil; Gainesville, Alachua County, Sanford, Seminole County, Sumner, Levey County, Simpson's Hummock, and near Long Key in the Everglades, Dade County, Florida: var. *eximea* Sarg., differing from the type in its narrow elliptic to narrow oblong-obovate leaves and pale bark; a tree rarely 20° high, with a trunk 8′–12′ in diameter; rarely a shrub; dry sandy open woods, near Springfield, Livingston Parish and near Hammond, Tangipahoa Parish, eastern Louisiana. The following small shrubby small-leaved forms are recognized: var. *fusiformis* Sarg., with oblong-ovate leaves acute at apex, rounded or cuneate at base, entire or occasionally dentate, and pale pubescent below, and small fruit; dry limestone ridges and flat-topped hills of the Edwards Plateau (Kerr and Comal Counties), western Texas: var. *dentata* Chapm., distinct in the oblong-obovate repand-dentate lower leaves with large triangular teeth, acute at the broad apex, often 4′ long and 1¼′ wide at the base of the stems, and much larger than the oblong-lanceolate entire upper leaves; common in sterile pine-barrens near the coast of Florida: var. *maritima* Sarg., with oblong-obovate or rarely lanceolate leaves, acute and apiculate or rounded at apex, cuneate at base, and entire or slightly and irregularly toothed above the middle; fruit solitary or in pairs, or rarely in elongated spikes (*Quercus succu-*

lenta Small); sandy barrens near the coast, South Carolina to Miami, Dade County, Florida: var. *pygmaea* Sarg., with oblong-obovate leaves, cuneate at base, 3–5 lobed at apex with small acute lobes, or rarely elliptic and entire, and nearly sessile fruit, the nut inclosed nearly to the apex; a shrub rarely 3° high; Pine-woods in sandy soil; widely distributed in Florida.

30. Quercus reticulata H. B. K.

Leaves broadly obovate, obtuse and rounded or rarely acute at apex, usually cordate or occasionally rounded at the narrow base, repandly spinose-dentate above the middle or only toward the apex with slender teeth, and entire below, when they unfold coated with dense fulvous tomentum, at maturity thick, firm, and rigid, dark blue and covered with scattered fascicled hairs above, paler and coated with thick fulvous pubescence below, 1′–5′ long, ¾′–4′ broad, with a thick midrib, and primary veins running to the points of the

Fig. 255

teeth or arcuate and united within the slightly revolute margins, and very conspicuous reticulate veinlets; petioles stout about ¼′ in length. **Flowers:** staminate in short tomentose aments in the axils of leaves of the year; calyx light yellow, hirsute, with pale hairs, divided into 5–7 ovate acute segments; pistillate in spikes on elongated peduncles, clothed like their involucral scales with hoary tomentum; stigmas dark red. **Fruit** usually in many-fruited spikes or occasionally in pairs or rarely solitary, on slender hirsute or glabrous peduncles 2′–5′ long; nut oblong, rounded or acute at the pilose apex, broad at base, about ½′ long, inclosed for about one fourth its length in a shallow cup-shaped cup dark brown and pubescent within, hoary tomentose without and covered by small ovate acute scales, with thin free scarious tips, slightly thickened and rounded on the back at the bottom of the cup.

A tree, rarely more than 40° high, with a trunk 1° in diameter, and stout branchlets coated at first with thick fulvous tomentum, light orange color and more or less thickly clothed with pubescence during their first winter, becoming ashy gray or light brown; in the United States usually shrubby in habit and sometimes only a few feet tall; becoming on the Sierra Madre of Mexico a large tree. **Winter-buds** ovoid to oval, often surrounded by the persistent stipules of the upper leaves, about ⅛′ long, with thin loosely imbricated light red scales ciliate on the margins. **Bark** about ¼′ thick, dark or light brown, and covered by small thin closely appressed scales. **Wood** very heavy, hard, close-grained, dark brown, with thick lighter colored sapwood.

Distribution. Near the summits of the mountain ranges of southeastern New Mexico (Mogollon Mountains) and southeastern Arizona, and southward in Mexico.

31. Quercus Toumeyi Sarg.

Leaves ovate or ovate-oblong or oval, acute and apiculate at apex, rounded or cordate at base, entire with thickened slightly revolute margins, or remotely spinulose-dentate, often minutely 3-toothed at apex, thin but firm in texture, light blue-green, glabrous and lustrous above, pale and puberulous below, conspicuously reticulate-venulose; $\frac{1}{2}'$–$\frac{3}{4}'$ long, $\frac{1}{4}'$–$\frac{1}{2}'$ wide; falling early in spring with the appearance of the new leaves; petioles stout,

Fig. 256

tomentose, about $\frac{1}{16}'$ in length. **Flowers** unknown. **Fruit** sessile, solitary or in pairs, ripening in June; nut oval or ovoid, $\frac{1}{2}'$–$\frac{2}{3}'$ long, $\frac{1}{4}'$ thick, light brown and lustrous, furnished at the acute apex with a narrow ring of pale pubescence, inclosed for about one half its length in a thin shallow tomentose cup light green and pubescent within, and covered by thin ovate regularly and closely imbricated light red-brown scales ending in a short rounded tip and coated on the back with pale tomentum.

A tree, 25°–30° high, with a short trunk 6′–8′ in diameter, dividing not far from the ground into numerous stout wide-spreading branches forming a broad irregular head, and slender branchlets bright red-brown more or less thickly coated with pale tomentum at midsummer, covered during their second and third years with thin dark brown nearly black bark broken into small thin closely appressed scales. **Wood** light brown, with thick pale sapwood.

Distribution. Forming an open forest on the Mule Mountains, Cochise County, southeastern Arizona.

32. Quercus arizonica Sarg. White Oak.

Leaves oblong-lanceolate to broadly obovate, generally acute or sometimes rounded at apex, rounded or cordate at base, repandly spinose-dentate usually, except on vigorous shoots, only above the middle or toward the apex, or entire and sometimes undulate on the margins, when they unfold light red clothed with bright fulvous tomentum and furnished with dark dental glands, at maturity thick, firm and rigid, dull dark blue-green and glabrate above, duller and covered with thick fulvous or pale pubescence below, 1′–4′ long, $\frac{1}{2}'$–2′ wide, with a broad yellow midrib, slender primary veins, arcuate and united near the thickened revolute margins, and coarsely reticulate veinlets; falling in the early spring just before the appearance of the new leaves; petioles stout, tomentose, $\frac{1}{4}'$–$\frac{1}{2}'$ in length. **Flowers:** staminate in tomentose aments 2′–3′ long; calyx pale yellow, pubescent, and divided into 4–7 broad acute ciliate lobes; anthers red or yellow; pistillate on short stems tomentose like their involucral scales. **Fruit** sessile or on hoary-tomentose stems rarely $\frac{1}{2}'$ long, usually solitary, ripening irregularly from September to November; nut oblong, oval or slightly

obovoid, obtuse and rounded at the puberulous apex, ¾′–1′ long, ½′ thick, dark chestnut-brown, lustrous and often striate, soon becoming light brown, inclosed for half its length in a cup-shaped or hemispheric cup light brown and pubescent within, covered by regularly and closely imbricated scales coated with pale tomentum and ending in thin light red pointed tips, those below the middle of the cup much thickened and rounded on the back; **seed** dark purple, very astringent.

A tree, occasionally 50°–60° tall, with a trunk 3°–4° in diameter, and thick contorted branches spreading nearly at right angles and forming a handsome round-topped symmetrical head, and stout branchlets clothed at first with thick fulvous tomentum persistent during their first winter, reddish brown or light orange color and pubescent or puberulous in their second season, ultimately glabrous and darker; usually not more than 30°–40° tall; at high elevations reduced to a low shrub. **Winter-buds** subglobose, about $\frac{1}{16}$′ long, with loosely imbricated bright chestnut-brown puberulous scales ciliate on the margins. **Bark** of young stems and branches thin, pale, scaly with small appressed scales, becoming on old trunks about 1′ thick and deeply divided by narrow fissures into broad ridges broken

Fig. 257

into long thick plate-like scales pale or ashy gray on the surface. **Wood** heavy, strong, hard, close-grained, dark brown or nearly black, with thick lighter colored sapwood; used only for fuel.

Distribution. The most common and generally distributed White Oak of southern New Mexico and Arizona, covering the slopes of cañons of mountain ranges at altitudes of from 5000°–10,000° above the sea, often ascending nearly to the summits of the high peaks; and in northern Mexico.

33. Quercus oblongifolia Torr. White Oak.

Leaves ovate, elliptic, or slightly obovate, rounded and occasionally emarginate or acute at apex, usually cordate or occasionally rounded at base, entire and sometimes undulate with thickened revolute margins, or remotely dentate with small callous teeth, on vigorous shoots and young plants oblong, rounded or cuneate at the narrow base, coarsely sinuate or undulate-toothed or 3-toothed at the broad apex and entire below, when they unfold bright red and coated with deciduous hoary tomentum, at maturity thin and firm, blue-green and lustrous above, paler below, 1′–2′ long, ½′–¾′ wide, or on vigorous shoots sometimes 3′–4′ long, with a prominent pale midrib, slender primary veins, and conspicuous reticulate veinlets; persistent during the winter without change of color, gradually turning yellow in the spring and falling at the appearance of the new leaves; petioles stout, nearly

terete, about $\frac{1}{4}'$ in length. **Flowers:** staminate in short hoary-tomentose aments; calyx bright yellow, pilose, divided into 5 or 6 laciniately cut or entire acute segments tinged with red above the middle; pistillate usually sessile, or on peduncles tomentose like the involucral scales; stigmas bright red. **Fruit** usually solitary and sessile, rarely long-stalked; nut ovoid, ellipsoidal, or slightly obovoid, full and rounded at apex surrounded by a narrow ring of white pubescence, dark chestnut-brown, striate, and very lustrous, soon becoming light brown in drying, $\frac{1}{2}'$–$\frac{3}{4}'$ long, about $\frac{1}{3}'$ thick, inclosed for about one third its length in a cup-shaped or rarely turbinate thin cup yellow-green and pubescent on the inner surface and covered by ovate-oblong scales slightly thickened on the back, coated with hoary tomentum and ending in thin acute bright red tips ciliate on the margins and sometimes forming a minute fringe to the rim of the cup.

Fig. 258

A tree, rarely more than 30° high, with a short trunk 18′–20′ in diameter, many stout spreading often contorted branches forming a handsome round-topped symmetrical head, and slender rigid branchlets coated at first with pale or fulvous tomentum, light red-brown, dark brown or dark orange color in their first winter, becoming ashy gray in their second or third year. **Winter-buds** subglobose, $\frac{1}{16}'$–$\frac{1}{8}'$ long, with thin light chestnut-brown scales. **Bark** $\frac{3}{4}'$–$1\frac{1}{4}'$ thick, ashy gray, and broken into small nearly square or oblong close plate-like scales. **Wood** very heavy, hard, strong, brittle, dark brown or nearly black, with thick brown sapwood; sometimes used as fuel.

Distribution. Chisos Mountains, western Texas, southeastern New Mexico, southern Arizona, and southward into northern Mexico; comparatively rare in Texas; abundant on the foothills of the mountain ranges of southern New Mexico and Arizona at altitudes of about 5000°, and dotting the upper slopes of the mesa where narrow cañons open to the plain.

34. Quercus Engelmannii Greene. Evergreen Oak.

Leaves oblong to obovate, usually obtuse and rounded or sometimes acute at apex, gradually or abruptly cuneate or rounded or cordate at base, entire, often undulate, or sinuate-toothed with occasionally rigid teeth, or at the ends of sterile branches frequently coarsely crenately serrate with incurved teeth, or rarely lobed with acute oblique rounded lobes, when they unfold bright red and coated with thick pale rufous tomentum, at maturity thick, dark blue-green and glabrous or covered with fascicled hairs above, pale, usually yellow-green and clothed with light brown pubescence, or puberulous or often glabrous below, 1′–3′ long, $\frac{1}{2}'$–2′ wide; deciduous in the spring with the appearance of the

new leaves; petioles slender, tomentose, becoming pubescent, $\frac{1}{4}'$–$\frac{1}{2}'$ in length. **Flowers:** staminate in slender hairy aments 2′–3′ long; calyx light yellow, pilose, with lanceolate acute segments; pistillate on slender peduncles, clothed like their involucral scales with dense pale tomentum. **Fruit** sessile or on slender pubescent peduncles sometimes $\frac{3}{4}'$ long; nut oblong, gradually narrowed and acute or broad rounded and obtuse at apex, broad or narrow at base, dark chestnut-brown more or less conspicuously marked by darker longitudinal stripes, turning light chestnut-brown in drying, $\frac{3}{4}'$–1′ long, about $\frac{1}{2}'$ thick, inclosed for about half its length in a deep saucer-shaped, cup-shaped or turbinate cup light brown and puberulous within, and covered by ovate light brown scales coated with pale tomentum, usually thickened, united and tuberculate at the base of the cup, and near its rim produced into small acute ciliate tips.

Fig. 259

A tree, 50°–60° high, with a trunk 2°–3° in diameter, thick branches spreading nearly at right angles and forming a broad rather irregular head, and stout rigid branchlets coated at first with hoary tomentum, light or dark brown tinged with red and pubescent during their first winter, becoming glabrous and light brown or gray in their second or third year. **Winter-buds** oval or ovoid, about $\frac{1}{3}'$ long, with thin light red pubescent scales. **Bark** $1\frac{1}{2}'$–2′ thick, light gray tinged with brown, deeply divided by narrow fissures and separating on the surface into small thin appressed scales. **Wood** very heavy, hard, strong, close-grained, brittle, dark brown or nearly black, with thick lighter brown sapwood; used only for fuel.

Distribution. Low hills of southwestern California west of the coast range, occupying with *Quercus agrifolia* Née, a belt about fifty miles wide, and extending to within fifteen or twenty miles of the coast, from the neighborhood of Sierra Madre and San Gabriel, Los Angeles County, to the mesa east of San Diego; in northern Lower California.

35. Quercus Douglasii Hook. & Arn. Blue Oak. Mountain White Oak.

Leaves oblong, acute or rounded at apex, gradually narrowed and cuneate or broad and rounded or subcordate at base, divided by deep or shallow, wide or narrow sinuses acute or rounded in the bottom into 4 or 5 broad or narrow acute or rounded often mucronate lobes, 2′–5′ long, 1′–$1\frac{3}{4}'$ wide, or oval, oblong or obovate, rounded or acute at apex, equally or unequally cuneate or rounded at base, regularly or irregularly sinuate-toothed with rounded acute rigid spinescent teeth, or denticulate toward the apex, 1′–2′ long, $\frac{1}{4}'$–1′ wide, when they unfold covered by soft pale pubescence, at maturity thin, firm and rather rigid, pale blue, with scattered fascicled hairs above, often yellow-green and covered by short

pubescence below, with a hirsute or puberulous prominent midrib and more or less conspicuous reticulate veinlets; petioles stout, tomentose, $\frac{1}{4}'$–$\frac{1}{2}'$ in length. **Flowers:** staminate in hairy aments $1\frac{1}{2}'$–$2'$ long; calyx yellow-green, coated on the outer surface with pale hairs, deeply divided into broad acute laciniately cut segments; pistillate in short few-flowered spikes coated like the involucral scales with hoary tomentum. **Fruit** sessile or short-stalked, solitary or in pairs; nut ellipsoidal, sometimes ventricose, with a narrow base, gradually narrowed and acute at apex, $\frac{3}{4}'$–$1'$ long, $\frac{1}{2}'$–$1'$ thick, or often ovoid and acute, green and lustrous, turning dark chestnut-brown in drying, with a narrow ring of hoary pubescence at apex, inclosed only at base in a thin shallow cup-shaped cup light green and pubescent on the inner surface, covered on the outer by small acute and usually thin or sometimes, especially in the south, thicker tumid scales coated with pale pubescence or tomentum and ending in thin reddish brown tips.

Fig. 260

A tree, usually 50°–60°, rarely 80°–90° high, with a trunk 3°–4° in diameter, short stout branches spreading nearly at right angles and forming a dense round-topped symmetrical head, stout branchlets brittle at the joints, coated at first with short dense hoary tomentum, dark gray or reddish brown and tomentose, pubescent, or puberulous during their first winter, becoming ultimately ashy gray or dark brown; frequently not more than 20°–30° high, and sometimes, especially southward shrubby, in habit. **Winter-buds** ovoid, obtuse, $\frac{1}{8}'$–$\frac{1}{4}'$ long, with light rather bright red pubescent scales. **Bark** $\frac{1}{2}'$–$1'$ thick, generally pale, and covered by small scales sometimes tinged with brown or light red. **Wood** hard, heavy, strong, brittle, dark brown, becoming nearly black with exposure, with thick light brown sapwood; largely used as fuel.

Distribution. Scattered over low hills, dry mountain slopes and valleys; California, Mendocino County, and the upper valley of the Sacramento River, southward along the western slopes of the Sierra Nevada up to elevations of 4000°, and through valleys of the coast ranges to the Tehachapi Pass, the borders of the Mohave Desert (Sierra de la Liebre) and the neighborhood of San Fernando, Los Angeles County; most abundant and of its largest size in the valleys between the coast mountains and the interior ridges of the coast ranges south of the Bay of San Francisco.

× *Quercus jolonensis* Sarg. with characters intermediate between those of *Quercus Douglasii* and *Quercus lobata* and believed to be a hybrid of those species occurs, with a number of large trees, at Jolon and between Jolon and King City, Monterey County, California.

36. Quercus Vaseyana Buckl. Shin Oak.

Quercus undulata var. *Vaseyana* Rydb.

Leaves oblong, rarely oblong-obovate, acute or rounded at apex, cuneate at base, undulately lobed with small acute lobes pointing forward, rarely nearly entire, when they unfold covered above with short fascicled hairs sometimes persistent until midsummer, and tomentose below, and at maturity thin, pale gray-green, glabrous and lustrous above, pale pubescent below, 1′–1½′ long and ½′–¾′ wide; deciduous late in winter or in early spring; petioles covered with fascicled hairs when they first appear, becoming glabrous, ¼′ in length. **Flowers:** staminate in villose aments 1′–1¼′ long; calyx deeply divided into 4 or 5 ovate scarious lobes rounded at apex and shorter than the stamens; pistillate on short to-

Fig. 261

mentose peduncles, their involucral scales ovate, acute, pubescent, shorter than the calyx-lobes; stigmas red. **Fruit** solitary or in pairs, sessile or short-stalked; nut ellipsoidal and only slightly narrowed at the rounded ends to oblong and slightly ovoid or obovoid, ½′–¾′ in length, ¼′–½′ in diameter, pale chestnut-brown and lustrous, the base only inclosed in the thin, saucer-shaped to cup-shaped cup, puberulous on the inner surface, covered with closely appressed ovate acute hoary tomentose scales, on some individuals abruptly contracted into short acute red-brown nearly glabrous tips.

A tree, rarely 15°–20° high, usually a shrub only 1°–3° tall, spreading into great thickets, with slender branchlets thickly covered with matted fascicled hairs during their first season, and light gray and glabrous or puberulous in their second year. **Winter-buds** ovoid or obovoid, about ⅛′ long, with red-brown scales ciliate on the margins. **Bark** rough, deeply furrowed and scaly.

Distribution. Limestone slopes and ridges or in sheltered cañons; western Texas; Kimble, Real, Kendall, Kerr, Uvalda, Edwards, Menard and Valverde Counties.

37. Quercus Mohriana Rydb. Shin Oak.

Leaves oblong-obovate to elliptic or lanceolate, acute, acuminate or rounded at apex, rounded or cuneate and often unsymmetrical at base, entire, undulate, sinuately toothed with triangular apiculate teeth, or occasionally irregularly lobed above the middle with rounded lobes, thick, gray-green, lustrous and covered above with short fascicled hairs,

and densely hoary tomentose below, 2°–4° long, ½′–1′ wide, with a stout midrib thickly covered with fascicled hairs, sometimes becoming glabrous, slender primary veins and reticulate veinlets; petioles stout, hoary tomentose, ⅛′–¼′ in length. **Flowers:** staminate in short hoary tomentose aments; calyx densely villose, deeply divided into broad ovate lobes rounded at apex; anthers red; pistillate on hoary tomentose peduncles, with hairy bracts and calyx-lobes. **Fruit** solitary or in pairs, nearly sessile or raised on a pubescent peduncle ½′–¾′ in length; nut ellipsoidal or ovoid, broad and rounded at the ends, light chestnut-brown, lustrous, ⅓′–½′ long, ¼′–⅓′ thick, inclosed for from half to two thirds its length in the hemispheric to cup-shaped cup, hoary tomentose on the inner surface, and

Fig. 262

covered with small closely appressed acute hoary tomentose scales much thickened below the middle of the cup, thin and much smaller toward its rim.

A tree, rarely 18°–20° high, with a trunk rarely 1° in diameter, small spreading and ascending branches forming a round-topped head, and slender branchlets thickly coated during their first season with fascicled hairs, dark gray-brown and pubescent in their second season and ultimately gray and glabrous; usually a low shrub spreading into thickets. **Winter-buds** broad-ovoid, obtuse, pale pubescent. **Bark** thin, pale, rough, deeply furrowed.

Distribution. On dry limestone hills, usually not more than 18° high with spreading branches; on deep sand, often not more than 3° high with more erect stems, often covering thousands of acres; only a tree in the protection of ledges in deep ravines and on steep hillsides; northwestern Texas (Tom Green, Coke, Nolan, Howard, Armstrong, and Wheeler Counties); central Texas (Bryan, Brazos County); southwestern Oklahoma (Beckham County).

38. Quercus Laceyi Small.

Leaves oblong to oblong-obovate, usually with two pairs of small rounded lateral lobes, occasionally 3-lobed toward the apex, rarely nearly entire, narrowed and rounded at apex, rounded, cuneate or rarely cordate at the gradually narrowed base, coated below when they unfold with loose white tomentum, soon glabrous, at maturity thin, blue-green above, yellow-green below, 2′–3′ long, ¾′–2′ wide, with a slender midrib and primary veins, and conspicuous reticulate veinlets; deciduous late in the autumn; on vigorous shoots sometimes 6′–7′ long and 3′–4′ wide; petioles glabrous or sparingly villose, ¼′–⅓′ in length. **Flowers:** staminate in slightly villose aments 2′–2½′ long; calyx deeply divided into 4 or 5

ovate acuminate lobes shorter than the stamens; pistillate flowers not seen. **Fruit** solitary or in pairs, sessile or raised on a stem up to $\frac{1}{2}'$ in length; nut ellipsoidal or oblong-ovoid, rounded at apex, slightly narrowed and nearly truncate at base, light chestnut-brown and lustrous, $\frac{3}{4}'$–$1'$ long, $\frac{1}{3}'$–$\frac{1}{2}'$ in diameter, the base inclosed in the thick, cup-shaped to rarely saucer-shaped cup, tomentose on the inner surface, covered with acute much thickened pale tomentose scales.

A tree, 30°–45° high, with a trunk 20′–30′ in diameter, heavy erect and spreading branches and slender branchlets villose when they first appear, soon becoming glabrous and red-brown or gray during their second season; often a tall shrub with numerous stems. **Winter-buds** ovoid, acute, $\frac{1}{6}'$ long, with chestnut-brown scales ciliate on the margins. **Bark** gray, thick, deeply ridged or checkered.

Fig. 263

Distribution. Rocky banks of streams, the steep sides of cañons and on limestone bluffs; common in the southern and southwestern parts of the Edwards Plateau, western Texas (Kendall, Kerr, Bandera, Uvalde, Menard, Kemble, Real and Edwards Counties); easily distinguished in the field by the peculiar smoky or waxy appearance of the foliage.

39. Quercus annulata Buckl.

Quercus breviloba Sarg.

Leaves oblong to oblong-obovate or elliptic, rounded or acute at apex, cuneate or rounded at base, entire, undulate, slightly lobed with rounded or acute lobes, or 3-lobed, when they unfold covered above with fascicled hairs and tomentose below, and at maturity green, glabrous and lustrous above, green and pubescent below on lower branches, often pale or hoary tomentose on upper branches, $1\frac{1}{4}'$–$2\frac{1}{2}'$ long, $\frac{1}{2}'$–$1\frac{1}{4}'$ wide; petioles covered when they first appear with fascicled hairs, soon glabrous, $\frac{1}{4}'$–$\frac{1}{2}'$ in length; on vigorous branchlets sometimes thinner, glabrous, divided into broad rounded lateral lobes, gradually narrowed and cuneate at the long base, 4′ long and $2\frac{1}{2}'$ wide. **Flowers**: staminate in pubescent aments 1′–2′ long; calyx deeply divided in villose rounded lobes, shorter than the stamens; anthers red; pistillate on tomentose peduncles, their scales rounded, tomentose; stigmas red. **Fruit** solitary or in 2 or 3-fruited clusters, sessile or short-stalked, oblong-ovoid to ellipsoidal, slightly narrowed and rounded at apex, light yellow-brown and lustrous, $\frac{3}{4}'$–$1'$ long, $\frac{1}{3}'$–$\frac{1}{2}'$ in diameter; inclosed for about a quarter of its length in the cup-shaped cup, tomentose on the inner surface, covered with acute tomentose scales somewhat thickened and closely appressed below the middle of the cup, their tips chestnut-brown, free and often glabrous.

A tree, 20°–30° tall with a trunk rarely more than 1° in diameter, small spreading often

slightly pendulous branches forming a round-topped head, and slender branches covered when they first appear with fascicled hairs, soon becoming glabrous and gray or grayish brown; the large stems often surrounded by a ring of smaller stems produced from its roots; more often a shrub than a tree spreading into broad thickets. **Winter-buds** ovoid

Fig. 264

to ellipsoidal, acute, $\frac{1}{8}'$–$\frac{1}{4}'$ long, with closely imbricated chestnut-brown puberulous scales ciliate on the margins. **Bark** thick, rough, deeply ridged.

Distribution. Dry limestone hills and bluffs; central and western Texas, from the neighborhood of Dallas, Dallas County, and Palo Pinto County to Kendall, Kerr, Brown, Bandera, Real and Menard Counties.

40. Quercus Durandii Buckl.

Quercus breviloba Sarg., in part.

Leaves thin, obovate to elliptic, entire, 3-lobed toward the rounded or acute apex or irregularly laterally lobed, the three forms appearing on different branches of the same tree, on lower branches usually lobed, dark green and lustrous above, often green and glabrous below, sometimes 6′ or 7′ long and 3′ or $3\frac{1}{2}'$ wide, on upper branches mostly entire, white and pubescent or tomentose below, $2\frac{1}{2}'$–3′ long, $\frac{1}{2}'$–$1\frac{1}{2}'$ wide; falling late in the autumn; petioles glabrous, $\frac{1}{3}'$–$\frac{1}{4}'$ in length. **Flowers:** staminate in slender villose aments 3′–4′ in length; calyx deeply divided into acute villose lobes shorter than the stamens; pistillate on a short tomentose peduncle, the linear acuminate bract and involucral scales hoary-tomentose; stigmas red. **Fruit** solitary or in pairs, short-stalked or nearly sessile; nut ovoid, or slightly obovoid, rounded or rarely acute at apex, nearly truncate at base, pale chestnut-brown, lustrous, $\frac{1}{2}'$–$\frac{2}{3}'$ long, $\frac{1}{3}'$–$\frac{1}{2}'$ thick, barely inclosed at base in the thin, shallow saucer-shaped cup, pale tomentose on the inner surface, and covered with small acuminate closely appressed tomentose scales slightly thickened on the back.

A tree, often 60°–90° high with a tall trunk 2°–3° in diameter, comparatively small branches, the lower horizontal, the upper ascending, forming a dense round-topped handsome head, and slender pale gray-brown branchlets covered when they first appear with fascicled hairs, soon glabrous, or puberulous during their first season, and darker in their second season. **Winter-buds** ovoid, acute, $\frac{1}{4}'$–$\frac{1}{3}'$ long with dark chestnut-brown rounded scales ciliate on the margins. **Bark** thin, light gray or nearly white and broken into thin loosely appressed scales.

Distribution. East of the Mississippi River scattered on rich limestone prairies; westward on the well drained soil of river bottoms, and often on low hummocks; near Augusta,

Richmond County, Georgia; West Point, Clay County, Columbus, Lowndes County, Brookville, Noxubee County, and near Natchez, Adams County, Mississippi; McNab, Hempstead County, Arkansas; Natchitoches, Natchitoches Parish, western Louisiana;

Fig. 265

coast region of eastern Texas to the bottoms of the Guadalupe River (Victoria County), ranging inland to San Saba County and to the neighborhood of Dallas, Dallas County; on the mountains near Monterey, Nuevo Leon; rare and local.

41. Quercus Chapmanii Sarg.

Leaves oblong to oblong-obovate, rounded at the narrow apex, narrowed and cuneate or rounded or broad and rounded at base, entire with slightly undulate margins, or ob-

Fig. 266

scurely sinuate-lobed above the middle, when they unfold coated below with thick bright yellow pubescence and covered above with pale fascicled deciduous hairs, at maturity

thick and firm or subcoriaceous, dark green, glabrous and lustrous above, light green or silvery white and glabrous below except on the slender often pubescent midrib, usually 2′–3′ long and 1′ wide, but varying from 1′–3′ in length and ¾′–1′ in width; falling gradually during the winter or sometimes persistent until the appearance of the new leaves in the spring; petioles tomentose, rarely ½′ in length. **Flowers:** staminate in short hirsute aments; calyx hirsute, divided into 5 acute laciniately cut segments; anthers hirsute; pistillate sessile or short-stalked, their involucral scales coated with dense pale tomentum. **Fruit** usually sessile, solitary or in pairs; nut oval, about ⅝′ long and ⅜′ thick, pubescent from the obtuse rounded apex nearly to the middle, inclosed for nearly half its length in the deep cup-shaped light brown cup slightly pubescent on the inner surface, and covered by ovate-oblong pointed scales thickened on the back, especially toward the base of the cup, and coated with pale tomentum except on their thin reddish brown margins.

Occasionally a tree, 50° high, with a trunk 1° in diameter, stout branches forming a round-topped head, and slender branchlets coated at first with dense bright yellow pubescence, becoming light or dark red-brown and puberulous during their first winter and ultimately ashy gray; more often a rigid shrub sometimes only 1°–2° tall. **Winter-buds** ovoid, acute, obtuse, about ⅛′ long, with glabrous or puberulous light chestnut-brown scales. **Bark** dark or pale, separating freely into large irregular plate-like scales.

Distribution. Sandy barrens usually in the neighborhood of the coast; Bluffton, Beaufort County, South Carolina, Colonels Islands, Liberty County, Georgia, southward along the east coast of Florida to the shores of Indian River; on the west coast from the valley of the Caloosahatchee River to the shores of Pensacola Bay, and in the interior of the peninsula from Lake County to Highlands County (neighborhood of Sebring); rare and local on the Atlantic coast; comparatively rare in the interior of the Florida peninsula; abundant in western Florida from the shores of Tampa Bay to those of Saint Andrews Bay.

42. Quercus macrocarpa Michx. Burr Oak. Mossy Cup Oak.

Leaves obovate or oblong, cuneate or occasionally narrow and rounded at base, divided by wide sinuses sometimes penetrating nearly to the midrib into 5–7 lobes, the terminal lobe large, oval or obovate, regularly crenately lobed, or smaller and 3-lobed at

Fig. 267

the rounded or acute apex, when they unfold yellow-green and pilose above and silvery white and coated below with long pale hairs, at maturity thick and firm, dark green, lustrous and glabrous, or occasionally pilose on the upper surface, pale green or silvery white and covered on the lower surface with soft pale or rarely rufous pubescence, 6′–12′ long,

3′–6′ wide, with a stout pale midrib sometimes pilose on the upper side and pubescent on the lower, large primary veins running to the points of the lobes, and conspicuous reticulate veinlets; turning dull yellow or yellowish brown in the autumn; petioles stout, $\frac{1}{3}$′–1′ in length. **Flowers:** staminate in slender aments 4′–6′ long, their yellow-green peduncles coated with loosely matted pale hairs; calyx yellow-green, pubescent, deeply divided into 4–6 acute segments ending in tufts of long pale hairs; pistillate sessile or stalked, their involucral scales broadly ovate, often somewhat tinged with red toward the margins and coated, like the peduncles, with thick pale tomentum; stigmas bright red. **Fruit** usually solitary, sessile or long-stalked, exceedingly variable in size and shape; nut ellipsoidal or broad-ovoid, broad at the base and rounded at the obtuse or depressed apex covered by soft pale pubescence, $\frac{3}{5}$′ long and $\frac{1}{3}$′ thick at the north, sometimes 2′ long and $1\frac{1}{2}$′ thick in the south, its cup thick or thin, light brown and pubescent on the inner surface, hoary-tomentose and covered on the outer surface by large irregularly imbricated ovate pointed scales, at the base of the cup thin and free or sometimes much thickened and tuberculate, and near its rim generally developed into long slender pale awns forming on northern trees a short inconspicuous and at the south a long conspicuous matted fringe-like border, inclosing only the base or nearly the entire nut.

A tree, sometimes 170° high, with a trunk 6°–7° in diameter, clear of limbs for 70°–80° above the ground, a broad head of great spreading branches, and stout branchlets coated at first with thick soft pale deciduous pubescence, light orange color, usually glabrous or occasionally puberulous during their first winter, becoming ashy gray or light brown and ultimately dark brown, sometimes developing corky wings often 1′–$1\frac{1}{2}$′ wide; usually not more than 80° high, with a trunk 3°–4° in diameter; toward the northwestern limits of its range sometimes a low shrub. **Winter-buds** broadly ovoid, acute or obtuse, $\frac{1}{8}$′–$\frac{1}{4}$′ long, with light red-brown scales coated with soft pale pubescence. **Bark** 1′–2′ thick, deeply furrowed and broken on the surface into irregular plate-like brown scales often slightly tinged with red. **Wood** heavy, strong, hard, tough, close-grained, very durable, dark or rich light brown, with thin much lighter colored sapwood; used in ship and boatbuilding, for construction of all sorts, cabinet-making, cooperage, the manufacture of carriages, agricultural implements, baskets, railway-ties, fencing, and fuel.

Distribution. Low rich bottom-lands and intervales, or rarely in the northwest on low dry hills; Nova Scotia and New Brunswick southward to the valley of the Penobscot River, Maine, the shore of Lake Champlain, Vermont, western Massachusetts, central, southern and western Pennsylvania, northern Delaware, northern West Virginia (Hardy and Grant Counties), and middle Tennessee, and westward through the valley of the Saint Lawrence River and along the northern shores of Lake Huron to southern Manitoba, through western New York and Ohio, northern Michigan, to Minnesota (except in the northeastern counties), eastern and northwestern Nebraska, the Black Hills of South Dakota, the Turtle Mountains of North Dakota, and northeastern Wyoming, and to central Kansas, the valley of the north Fork of the Canadian River (Canton, Blaine County, and Seiling, Dewey County), Oklahoma, Caldwell Parish, Louisiana (*R. S. Cocks*), and the valley of the San Saba River (Menard County and Callahan County), Texas; attaining its largest size in southern Indiana and Illinois; the common Oak of the "oak openings" of western Minnesota, and in all the basin of the Red River of the North, ranging farther to the northwest than the other Oaks of eastern America; common and generally distributed in eastern Nebraska, and of a large size in cañons or on river bottoms in the extreme northwestern part of the state; the most generally distributed Oak in southern Wisconsin, and in Kansas growing to a large size in all the eastern part of the state.

Occasionally planted as an ornamental tree in the eastern United States and in South Africa.

× *Quercus Andrewsii* Sarg., believed to be a hybrid of *Quercus macrocarpa* and *Q. undulata* Torr., in habit and characters intermediate between those of its supposed parents with which it grows, occurs at Seiling, Dewey County, western Oklahoma.

× *Quercus guadalupensis* Sarg., with characters intermediate between those of *Quercus*

macrocarpa and *Q. stellata* and evidently a hybrid of these species, occurs at Fredericksburg Junction in the valley of the Guadalupe River, Kendall County, Texas.

× *Quercus Hillii* Trel., believed to be a hybrid of *Quercus macrocarpa* and *Q. Muehlenbergii*, has been found at Roby, Lake County, Indiana, and near Independence, Jackson County, Missouri.

43. Quercus lyrata Walt. Overcup Oak. Swamp White Oak.

Leaves oblong-obovate, gradually narrowed and cuneate at base, divided into spreading or ascending lobes by deep or shallow sinuses rounded, straight, or oblique on the bottom, the terminal lobe oblong-ovate, usually broad, acute or acuminate at the elongated apex, and furnished with 2 small entire nearly triangular lateral lobes, the upper lateral lobes broad, more or less emarginate, or acuminate and entire or slightly lobed and much longer than the acute or rounded lower lobes, when they unfold bronze-green and pilose above with caducous hairs, and coated below with thick pale tomentum, at maturity thin and firm, dark green and glabrous above, silvery white and thickly coated with pale pubescence, or green and often nearly glabrous below, 7′–10′ long, 1′–4′ wide; turning yellow or scarlet and orange in the autumn; petioles glabrous or pubescent, $\frac{1}{3}$′–1′ in length. **Flowers:** staminate in slender hairy aments 4′–6′ long; calyx light yellow, coated on the outer surface with pale hairs and divided into acute segments; pistillate sessile or stalked, their involucral scales covered, like the peduncles, with thick pale tomentum. **Fruit** sessile or borne on slender pubescent peduncles sometimes $1\frac{1}{2}$′ in length; nut subglobose to ovoid or rarely to ovoid-oblong, $\frac{1}{2}$′–1′ long, usually broader at base than long, light chestnut-brown, more or less covered above the middle with short pale pubescence, entirely or for two thirds of its length inclosed in the ovoid, nearly spherical or deep cup-shaped thin cup, bright red-brown and pubescent on the inner surface, hoary-tomentose and covered on the outer by ovate united scales produced into acute tips, much thickened and contorted at its base, gradually growing thinner and forming a ragged edge to the thin often irregularly split rim of the cup.

Fig. 268

A tree, rarely 100° high, with a trunk 2°–3° in diameter, generally divided 15°–20° above the ground into comparatively small often pendulous branches forming a handsome symmetrical round-topped head, and slender branchlets green more or less tinged with red and pilose or pubescent when they first appear, light or dark orange-color or grayish brown and usually glabrous during their first winter, ultimately becoming ashy gray or light brown. **Winter-buds** ovoid, obtuse, about $\frac{1}{5}$′ long, with light chestnut-brown scales covered, especially near their margins, with loose pale tomentum. **Bark** $\frac{3}{4}$′–1′ thick, light

gray tinged with red and broken into thick plates separating on the surface into thin irregular appressed scales. **Wood** heavy, hard, strong, tough, very durable in contact with the ground, rich dark brown, with thick lighter colored sapwood; confounded commercially with the wood of *Quercus alba*, and used for the same purpose.

Distribution. River swamps and small deep depressions on rich bottom-lands, usually wet throughout the year; southern New Jersey (Riddleton, Salem County), and valley of the Patuxent River, Maryland, southward near the coast to western Florida, through the Gulf states to the valley of the Navasota River, Brazos County, Texas, and through Arkansas to the valley of the Meramec River (Allenton, St. Louis County), Missouri, and to central Tennessee and Kentucky, southern Illinois, and southwestern Indiana to Spencer County; comparatively rare in the Atlantic and east Gulf states; most common and of its largest size in the valley of the Red River, Louisiana, and the adjacent parts of Texas and Arkansas. Three individuals of this tree in the neighborhood of the town of Amana, Iowa County, Iowa, far north of its known range, are reported by Professor B. Shimek of the University of Iowa (see Bull. Torrey Bot. Club, xliv. 293, t. 16 and 17 [1922]).

Occasionally cultivated in the northeastern states and hardy in eastern Massachusetts.

× *Quercus Comptonae* Sarg., a hybrid of *Quercus lyrata* and *Q. virginiana*, with characters intermediate between those of its parents, discovered many years ago on the banks of Peyton's Creek, Matagorda County, Texas (now gone), occurs with several individuals near dwellings in Natchez, Adams County, Mississippi, near Selma, Dallas County, Alabama, and in Audubon Park and streets, New Orleans, Louisiana. A tree, sometimes 100° high and one of the handsomest of North American Oaks; also produced artificially by *Professor H. Ness* by crossing *Quercus lyrata* and *Q. virginiana*.

44. Quercus stellata Wang. Post Oak.

Quercus minor Sarg.

Leaves oblong-obovate, usually deeply 5-lobed, with broad sinuses oblique in the bottom, and short wide lobes, broad and truncate or obtusely pointed at apex, gradually narrowed and cuneate, or occasionally abruptly narrowed and cuneate or rounded at base, when

Fig. 269

they unfold dark red above and densely pubescent, at maturity thick and firm, deep dark green and roughened by scattered fascicled pale hairs above, covered below with gray, light yellow, or rarely silvery white pubescence, usually 4′–5′ long and 3′–4′ across the lateral lobes, with a broad light-colored midrib pubescent on the upper side and tomentose or pubescent on the lower, stout lateral veins arcuate and united near the margins and

connected by conspicuous coarsely reticulated veinlets; turning dull yellow or brown in the autumn; petioles stout, pubescent, $\frac{1}{2}'$ to nearly $1'$ in length. **Flowers:** staminate in aments 3′–4′ long; calyx hirsute, yellow, usually divided into 5 ovate acute laciniately cut segments; anthers covered by short scattered pale hairs; pistillate sessile or stalked, their involucral scales broadly ovate, hirsute; stigmas bright red. **Fruit** sessile or short-stalked; nut oval to ovoid or ovoid-oblong, broad at base, obtuse and naked or covered with pale persistent pubescence at apex, $\frac{1}{2}'$–$1'$ long, $\frac{1}{4}'$–$\frac{3}{4}'$ thick, sometimes striate with dark longitudinal stripes, inclosed for one third to one half its length in the cup-shaped, turbinate, or rarely saucer-shaped cup pale and pubescent on the inner surface, hoary-tomentose on the outer surface, and covered by thin ovate scales rounded and acute at apex, reddish brown, and sometimes toward the rim of the cup ciliate on the margins with long pale hairs.

A tree, rarely 100° high, with a trunk 2°–3° in diameter, and stout spreading branches forming a broad dense round-topped head, and stout branchlets coated at first, like the young leaves and petioles, the stalks of the aments of staminate flowers and the peduncles of the pistillate flowers, with thick orange-brown tomentum, light orange color to reddish brown, and covered by short soft pubescence during their first winter, ultimately gray, dark brown, nearly black or bright brown tinged with orange color; usually not more than 50°–60° tall, with a trunk 1°–2° in diameter, and at the northeastern limits of its range generally reduced to a shrub. **Winter-buds** broadly ovoid, obtuse or rarely acute, $\frac{1}{8}'$–$\frac{1}{4}'$ long, with bright chestnut-brown pubescent scales coated toward the margins with scattered pale hairs. **Bark** $\frac{1}{2}'$–$1'$ thick, red more or less deeply tinged with brown, and divided by deep fissures into broad ridges covered on the surface with narrow closely appressed or rarely loose scales. **Wood** very heavy, hard, close-grained, durable in contact with the soil, difficult to season, light or dark brown, with thick lighter colored sapwood; largely used for fuel, fencing, railway-ties, and sometimes in the manufacture of carriages, for cooperage, and in construction.

Distribution. Dry gravelly or sandy uplands; Cape Cod and islands of southern Massachusetts, Rhode Island, Long Island, New York, to western Florida and southern Alabama and Mississippi, and from New York westward to southern Iowa, Missouri, eastern Kansas, western (Dewey County) Oklahoma, Louisiana and Texas; most abundant and of its largest size in the Mississippi basin; ascending on the southern Appalachian Mountains to altitudes of 2500°; the common Oak of central Texas on limestone hills and sandy plains forming the Texas "Cross Timbers"; usually shrubby and rare and local in southern Massachusetts; more abundant southward from the coast of the south Atlantic and the eastern Gulf states to the lower slopes of the Appalachian Mountains; in western Louisiana rarely in the moist soil of low lands.

Showing little variation in the shape of the fruit and in the character of the cup scales *Quercus stellata* is one of the most variable of North American Oaks in habit, in the nature of the bark, and in the presence or absence of pubescence. Some of the best marked varieties are var. *araniosa* Sarg., a large tree differing from the type in the usually smooth upper surface of the leaves, in the floccose persistent tomentum on their lower surface, in the less stout usually glabrous yellow or reddish branchlets, and in its scaly bark; dry sandy soil, southern Alabama, western Louisiana, southern Arkansas, eastern Oklahoma and eastern Texas. Var. *paludosa* Sarg., a tree up to 75° in height, differing from the type in its oblong-obovate leaves 3-lobed above the middle, slightly pubescent branchlets becoming nearly glabrous, and in its scaly bark; in rich deep soil on the often inundated bottoms of Kenison Bayou, near Washington, St. Landry Parish, Louisiana. Var. *attenuata* Sarg., a large tree differing from the type in the oblong to oblong-obovate narrow leaves 3-lobed at apex and gradually narrowed to the long cuneate base; near Arkansas Post on the White River, Arkansas County, Arkansas. Var. *parviloba* Sarg., a round-topped tree 25°–30° high, differing from the type in the smaller lobes of the leaves with more prominent reticulate veinlets; dry sandstone hills near Brownwood, Brown County, Texas. Var. *anomala* Sarg., a tree 15°–18° high, differing from the type in its broadly obovate subcoriaceous leaves slightly 3-lobed and rounded at apex; dry sandstone hills near Brownwood, Brown County, Texas; possibly a hybrid. Var. *Palmeri* Sarg., a shrub 6°–15° high, forming clumps,

differing from the type in its narrow oblong or slightly obovate 5–7-lobed leaves with narrow lobes, densely tomentose below, and in the thicker and more tomentose scales of the cup; sandy uplands, Elk City, Beckham County, Oklahoma. Var. *rufescens* Sarg., a shrub 12°–15° high, forming large clumps, differing from the type in the rusty brown pubescence on the lower surface of the polymorphous leaves, in the deeper cups of the fruit with thicker basal scales; sandy uplands, Big Spring, Howard County, Texas, and Elk City, Beckham County, Oklahoma. Var. *Boyntonii* Sarg, a shrub or small tree spreading into thickets, rarely more than 15° in height, differing from the type in its obovate leaves, mostly 3–5-lobed toward the apex, with small rounded lobes, and in their yellow-brown pubescence also found on the branchlets; in glades on the summit of Lookout Mountain, above Gadsden and Attala, Etowah County, Alabama.

The common and most widely distributed of the varieties of the Post Oak is

Quercus stellata var. Margaretta Sarg.

Quercus Margaretta Ashe

Leaves oblong-obovate, rounded at apex, cuneate or rounded at base, 3–5-lobed with usually narrow rounded, but often broad and truncate lobes, the two forms frequently occurring on the same branch, usually becoming glabrous on the upper surface early in the season, slightly pubescent, sometimes becoming nearly glabrous below, $2\frac{1}{2}'$–$5'$ long and $2'$–$2\frac{1}{2}'$ wide; petioles glabrous or pubescent. **Flowers** and **Fruit** as in the species.

A small tree, rarely 40° high, with slender glabrous reddish or reddish brown branchlets. **Winter-buds** ovoid, acute, $\frac{1}{4}'$ long with closely imbricated chestnut-brown scales glabrous, or ciliate on the margins. **Bark** thick, rough and furrowed, light gray.

Distribution. Usually on dry sandy slopes, hills and ridges, and southward on Pine-

Fig. 270

barren lands; coast of Virginia (Capron, Southampton County) southward in the coast and middle districts to central (Lake and Orange Counties) and western Florida, through central and southern Alabama, and eastern and southern Mississippi; in Western Louisiana (Natchitoches and Caddo Parishes); southern Arkansas (McNab, Hempstead County), and southwestern Missouri (Prosperity, Jasper County). The common Post Oak of the south Atlantic and Gulf states; occasionally a shrub (f. *stolonifera* Sarg.) 4°–6° high, with smaller leaves, spreading into broad thickets by stoloniferous shoots; common near Selma, Dallas County, Alabama, and on the dry sand hills of central Oklahoma.

× *Quercus Harbisonii* Sarg., believed to be a hybrid of *Quercus stellata* var. *Margaretta* and *Q. virginiana* var. *geminata*, has been found in the neighborhood of Jacksonville, Duval County, Florida.

45. Quercus Garryana Hook. White Oak.

Leaves obovate to oblong, pointed at apex, cuneate or rounded at base, coarsely pinnatifid-lobed, with slightly thickened revolute margins, coated at first with soft pale lustrous pubescence, at maturity thick and firm or subcoriaceous, dark green, lustrous and glabrous above, light green or orange-brown and pubescent or glabrate below, 4′–6′ long, 2′–5′ wide, with a stout yellow midrib, and conspicuous primary veins spreading at right angles, or gradually diverging from the midrib and running to the points of the lobes; sometimes turning bright scarlet in the autumn; petioles stout, pubescent, ½′–1′ in length. **Flowers:** staminate in hirsute aments; calyx glabrous, laciniately cut into ovate acute slightly ciliate or linear-lanceolate much elongated segments; pistillate sessile and coated with pale tomentum. **Fruit** sessile or short-stalked; nut oval to slightly obovoid and obtuse, 1′–1¼′ long and ½′–1′ thick, inclosed at the base in a shallow cup-shaped or slightly turbinate cup puberulous and light brown on the inner surface, pubescent or tomentose

Fig. 271

on the outer, and covered by ovate acute scales with pointed and often elongated tips, thin, free, or sometimes thickened and more or less united toward the base of the cup, decreasing from below upward.

A tree, usually 60°–70° or sometimes nearly 100° high, with a trunk 2°–3° in diameter, stout ascending or spreading branches forming a broad compact head, and stout branchlets coated at first with thick pale rufous pubescence, pubescent or tomentose and light or dark orange color during their first winter, becoming glabrous and rather bright reddish brown in their second year and ultimately gray; frequently at high altitudes, or when exposed to the winds from the ocean, reduced to a low shrub. **Winter-buds** ovoid, acute, ⅓′–½′ long, densely clothed with light ferrugineous tomentum. **Bark** ⅛′–1′ thick, divided by shallow fissures into broad ridges separating on the surface into light brown or gray scales sometimes slightly tinged with orange color. **Wood** strong, hard, close-grained, frequently exceedingly tough, light brown or yellow, with thin nearly white sapwood; in Oregon and Washington used in the manufacture of carriages and wagons, in cabinet-making, shipbuilding, and cooperage, and largely as fuel.

Distribution. Valleys and the dry gravelly slopes of low hills; Vancouver Island and the valley of the lower Fraser River southward through western Washington and Oregon and the California coast-valleys to Marin County; rare and local and the only Oak-tree in British Columbia; abundant and of its largest size in the valleys of western Washington and Oregon; on the islands in the northern part of Puget Sound reduced to a low shrub

(Vine Oak); ascending in its shrubby forms to considerable altitudes on the western slopes of the Cascade Mountains; abundant in northwestern California; less common and of smaller size southward.

46. Quercus utahensis Rydb.

Leaves oblong-obovate, gradually narrowed and rounded or cuneate at base, divided often nearly to the midrib by broad or narrow sinuses into four or five pairs of lateral lobes rounded or acute at apex, the upper lobes usually again lobed or undulate, the ter-

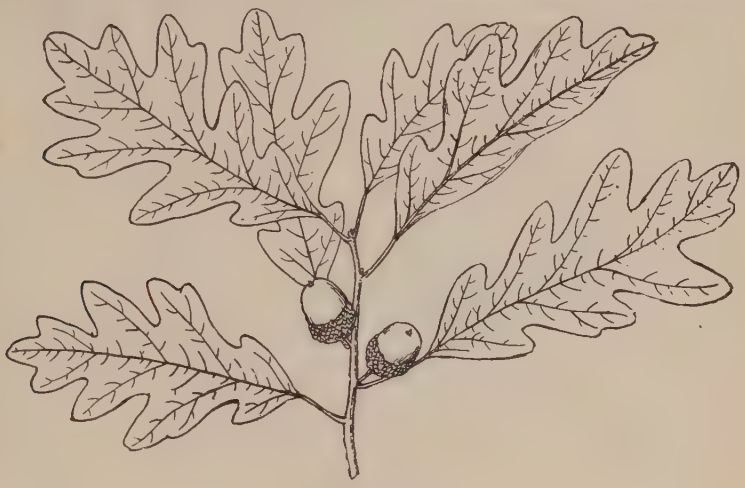

Fig. 272

minal lobe rounded at apex, entire or three-lobed, thick, dark green, glabrous or nearly glabrous above, pale and soft pubescent below, $2\frac{1}{2}'$–$7'$ long, $1\frac{1}{2}'$–$3\frac{1}{2}'$ wide, with a prominent midrib and primary veins, and conspicuous veinlets; petioles stout, hoary-tomentose early in the season, pubescent or glabrous before maturity, $\frac{2}{3}'$–$1'$ in length. **Flowers:** staminate in aments covered with fascicled hairs, $2'$–$2\frac{1}{2}'$ long; calyx scarious, divided to the middle by wide sinuses into narrow acuminate lobes; anthers yellow; pistillate usually solitary or in pairs, the scales of the involucre thickly coated with hoary tomentum. **Fruit** usually solitary, sessile or raised on a stout pubescent peduncle $\frac{1}{4}'$–$\frac{1}{2}'$ in length; nut ovoid, broad and rounded at the ends, $\frac{3}{5}'$–$\frac{3}{4}'$ long, $\frac{1}{2}'$–$2\frac{1}{2}'$ thick, usually inclosed for about half its length in the thick hemispheric cup covered with broad ovate pale pubescent scales much thickened on the back and closely appressed below the middle of the cup, gradually reduced in size upward, thin and less closely appressed toward its rim bordered by the free projecting tips of the upper row of scales.

A tree, occasionally 30° high, with a trunk $4'$–$8'$ in diameter, thick erect branches forming a narrow open head, and stout branchlets red-brown and covered with fascicled hairs when they first appear, becoming light orange-brown and puberulous. **Bark** dark gray-brown, rough and scaly.

Distribution. Dry foothill slopes and the sides of cañons; borders of southwestern Wyoming to the eastern base of the Rocky Mountains of Colorado, and to Utah, northern New Mexico and Arizona, passing into var. *mollis* Sarg. with thinner scales on the lower part of the cup of the fruit; with the species over its whole range, but most abundant on the Colorado Plateau of northern Arizona; here rarely 40° high, with a trunk $18'$–$20'$ in diameter.

47. Quercus lobata Née. White Oak. Valley Oak.

Leaves oblong to obovate, deeply 7–11 obliquely lobed, rounded at the narrow apex, narrow and cuneate or broad and rounded or cordate at base, the lateral lobes obovate, obtuse or retuse, or ovate and rounded, thin, $2\frac{1}{2}'$–$3'$ or rarely $4'$ long, $1'$–$2'$ wide, dark green and pubescent above, pale and pubescent below, with a stout pale midrib, and conspicuous yellow veins running to the slightly thickened and revolute margins; petioles stout, hirsute, $\frac{1}{4}'$–$\frac{1}{2}'$ in length. **Flowers:** staminate in hirsute aments $2'$–$3'$ long; calyx light yellow and divided into 6 or 8 acute pubescent ciliate lobes; pistillate solitary, sessile or rarely in elongated few-flowered spikes, their involucral scales broadly ovate, acute, coated with

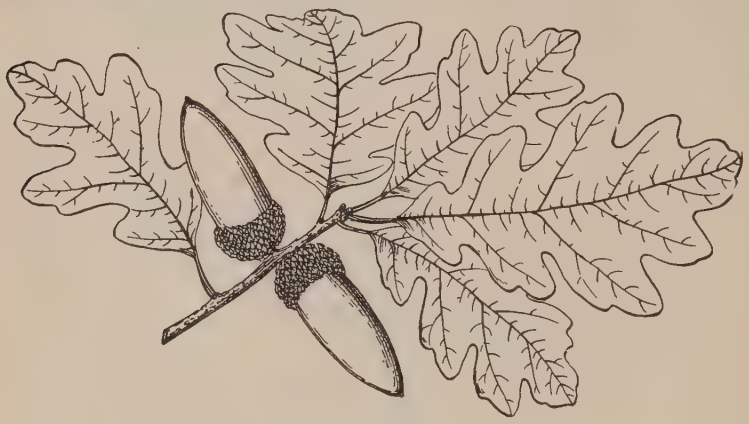

Fig. 273

dense pale tomentum, about as long as the narrow calyx-lobes. **Fruit** solitary or in pairs, nearly sessile; nut conic, elongated, rounded or pointed at apex, $1\frac{1}{4}'$–$2\frac{1}{4}'$ long, bright green and lustrous when fully grown, becoming bright chestnut-brown, usually inclosed for about one third its length in the cup-shaped cup coated with pale tomentum on the outer surface, usually irregularly tuberculate below, all but the much-thickened basal scales elongated into acute ciliate chestnut-brown free tips longest on the upper scales and forming a short fringe-like border to the rim of the cup.

A tree, often 100° feet high, with a trunk generally 3°–4°, but sometimes 10° in diameter, divided near the ground or usually 20°–30° above it into great limbs spreading at wide angles and forming a broad head of slender branches hanging gracefully in long sprays and sometimes sweeping the ground; less frequently with upper limbs growing almost at right angles with the trunk and forming a narrow rigid head of variously contorted erect or pendant branches, and slender branchlets coated at first with short silky canescent pubescence, ashy gray, light reddish brown, or pale orange-brown and slightly pubescent in their first winter, becoming glabrous and lighter colored during their second year. **Winter-buds** ovoid, acute, usually about $\frac{1}{4}'$ long, with orange-brown pubescent scales scarious and frequently ciliate on the margins. **Bark** $\frac{3}{4}'$–$1\frac{1}{2}'$ thick and covered by small loosely appressed light gray scales slightly tinged with orange or brown, becoming at the base of old trees frequently $5'$–$6'$ thick and divided by longitudinal fissures into broad flat ridges broken horizontally into short plates. **Wood** hard, fine-grained, brittle, light brown, with thin lighter colored sapwood; used only for fuel.

Distribution. Valleys of western California between the Sierra Nevada and the ocean from the valley of the Trinity River to Kern and Los Angeles (rare) Counties; most abundant and forming open groves in the central valleys of the state.

48. Quercus leptophylla Rydb.

Leaves oblong to oblong-obovate, cuneate or rarely rounded at base, divided about halfway to the midrib into two to four acute or rounded lateral lobes entire or occasionally furnished on the lower side with a small nearly triangular lobe, the terminal lobe short, entire, rounded at apex or three-lobed, when they unfold thickly coated with hoary tomentum, about one-third grown when the flowers open and then covered above with fascicled hairs and tomentose below, at maturity thin, dark green, lustrous and glabrous or nearly glabrous on the upper surface, yellow-green and covered below by short white hairs most abundant on the midrib and veins, $3\frac{1}{2}'$–$4'$ long, $1\frac{1}{2}'$–$2'$ wide; petioles slender, pubescent $\frac{1}{3}'$–$\frac{1}{2}'$ in length. **Flowers:** staminate in slender villose aments; calyx scarious, divided into five or six narrow acute lobes; anthers dark red-brown as the flowers open; pistil-

Fig. 274

late not seen. **Fruit** solitary or racemose, sessile or raised on a stout tomentose peduncle $\frac{2}{5}'$–$\frac{3}{5}'$ in length; nut oblong-ovoid, abruptly narrowed and rounded at base, gradually narrowed and rounded at apex, $\frac{1}{2}'$–$\frac{3}{4}'$ long; inclosed for half its length in the thin, hemispheric cup, $\frac{2}{5}'$–$\frac{1}{2}'$ in diameter, and covered with acuminate only slightly thickened appressed scales densely covered with hoary tomentum.

A tree, 30°–45° high, with a trunk 16′–24′ in diameter, heavy spreading ashy gray branches forming a round-topped head, and stout branchlets, light red-brown or purple and covered with long fascicled hairs when they first appear, becoming light brown and glabrous before autumn. **Bark** thick, deeply furrowed, covered with small appressed pale gray scales.

Distribution. Rich bottom-lands of the Cucharas River above La Veta, Huerfano County, Colorado; on the Mogollon Mountains, Socorro County, New Mexico.

49. Quercus austrina Small.

Leaves oblong-obovate, acute or rounded at apex, gradually narrowed to the long cuneate base or rarely rounded at base, usually 5-lobed with rounded lobes, the terminal lobe often 3-lobed, the upper lateral lobes pointing forward and much larger than those of the lower pair, or occasionally 3-lobed at the broad apex, or rarely nearly entire with undulate margins, when they unfold sparsely covered below with caducous fascicled hairs, at maturity glabrous, dark green and lustrous above, paler below, 3′–8′ long, 1′–4′ wide, with a prominent midrib and slender primary veins; petioles slender, at first pubescent, soon glabrous, $\frac{1}{4}$′–$\frac{1}{3}$′ in length. **Flowers** not seen. **Fruit** solitary or in pairs, sessile or raised on a stout stalk up to $\frac{1}{2}$′ in length; nut ovoid, slightly narrowed toward the base, narrowed at the rounded pubescent apex, $\frac{1}{2}$′–$\frac{3}{4}$′ long, $\frac{1}{2}$′ thick, inclosed for a third to a

Fig. 275

half its length in the thin hemispheric or deep cup-shaped cup, pale tomentose on the inner surface and covered with thin narrow loosely appressed blunt-pointed tomentose scales.

A tree, 70°–80° and rarely 100° high, with a tall trunk 2°–3° in diameter, spreading and ascending branches forming a broad rather open head, and slender glabrous red-brown or gray-brown brittle-jointed branchlets. **Winter-buds** ovoid to ellipsoid, acute, $\frac{1}{8}$′–$\frac{1}{4}$′ long, with closely imbricated acute puberulous chestnut-brown scales ciliate on the margins. **Bark** pale, scaly, and on old trunks divided into broad ridges.

Distribution. Banks of streams and river bluffs in deep rich soil; coast of South Carolina (Bluffton, Clay County, and near Charleston); Dover, Scriven County, McIntosh County, De Soto, Sumter County, and near Bainbridge, Decatur County, Georgia, to central and western Florida (Gainsville, Alachua County, near Santos, Marion County, Lake City, Columbia County, River Junction, Gadsden County, Marianna, Jackson County); western Alabama (Gallion, Hale County, and the neighborhood of Selma [common] and Pleasant Hill, Dallas County); and southern Mississippi (Meridian, Lauderdale County, Laurel, Jones County, Byram and near Jackson, Hinds County, near Natchez, Adams County).

50. Quercus alba L. White Oak.

Leaves oblong-obovate, gradually narrowed and cuneate at base, divided often nearly to the midrib by narrow or broad sinuses usually oblique in the bottom into 7 or 9 lobes, the lateral, narrow, lanceolate or obovate, pointing forward, rounded or acute and often lobed at apex, the terminal usually obovate and 3-lobed, when they unfold bright red above, pale

below and coated with soft pubescence, soon becoming silvery white and very lustrous, at maturity thin, firm, glabrous, bright green and lustrous or dull above, pale or glaucous below, 5′–9′ long, 2′–4′ wide, with a stout bright yellow midrib and conspicuous primary veins; turning late in the autumn deep rich vinous red, gradually withering and sometimes remaining on the branches nearly through the winter; petioles stout, glabrous, ½′–1′ in length. **Flowers:** staminate in hirsute or nearly glabrous aments 2½′–3′ long; calyx bright yellow and pubescent, with acute lobes; pistillate bright red, their involucral scales broadly ovate, hirsute, about as long as the ovate acute calyx-lobes. **Fruit** sessile or raised on a slender peduncle 1′–2′ long, the two forms sometimes appearing on the same branch; nut ovoid to oblong, rounded at apex, lustrous, ¾′ long, green when fully grown, becoming light chestnut-brown, inclosed for about one fourth its length in the cup-shaped cup coated with pale

Fig. 276

or light brown tomentum, its scales at the base much thickened, united and produced into short obtuse membranaceous tips, and thinner toward the rim of the cup.

A tree, 80°–100° high, with a trunk 3°–4° in diameter, tall and naked in the forest, short in the open, and surmounted by a broad round-topped head of stout limbs spreading irregularly, small rigid branches, and slender branchlets at first bright green, often tinged with red, and coated with a loose mass of long pale or ferrugineous deciduous hairs, reddish brown during the summer, bright red and lustrous or covered with a glaucous bloom during their first winter, becoming ultimately ashy gray. **Winter-buds** broadly ovoid, rather obtuse, dark red-brown, about ⅛′ long. **Bark** light gray slightly tinged with red or brown, or occasionally nearly white, broken into thin appressed scales, becoming on old trunks sometimes 2′ thick and divided into broad flat ridges. **Wood** strong, very heavy, hard, tough, close-grained, durable, light brown, with thin light brown sapwood; used in shipbuilding, for construction and in cooperage, the manufacture of carriages, agricultural implements, baskets, the interior finish of houses, cabinet-making, for railway-ties and fences, and largely as fuel.

Distribution. Sandy plains and gravelly ridges, rich uplands, intervales, and moist bottom-lands, sometimes forming nearly pure forests; southern Maine to southwestern Quebec, westward through southern Ontario, the southern peninsula of Michigan, southeastern Minnesota, eastern Iowa, and southeastern Nebraska, and southward to western Florida, through the Gulf states to the valley of the Brazos River, Texas and through Arkansas to eastern Oklahoma, eastern Kansas, Missouri, Tennessee, and Kentucky; ascending the southern Appalachian Mountains as a low bush to altitudes of 4500°;

most abundant and of its largest size on the lower western slopes of the Alleghany Mountains and on the bottom-lands of the lower Ohio Basin. Passing into

Quercus alba var. latiloba Sarg.

Leaves obovate-oblong, acute or rounded at apex, gradually narrowed and cuneate at base, divided usually less than half way to the midrib into broad rounded lobes; rarely obovate, with undulate margins, or slightly lobed, with broad rounded lobes (var. *repanda* Michx.). **Flowers** as in the type. **Fruit** rarely more than $1\frac{1}{2}'$ in length, with usually thinner cup scales.

Fig. 277

Distribution. More abundant than the species and the common northern White Oak; the var. *repanda* very common in Ponchartrain Parish, Louisiana, and in Richland County, Illinois.

× *Quercus Beadlei* Trel., believed to be a hybrid of *Quercus alba* and *Q. Prinus*, has been found in a swamp near Clarkton, Bladen County, North Carolina.

× *Quercus Bebbiana* Schn., probably a hybrid of *Quercus alba* and *Q. macrocarpa*, occurs at Charlotte, Chittenden County, Vermont, and near Kenton, Hardin County, Ohio.

× *Quercus Deamii* Trel., with characters intermediate between those of *Quercus alba* and *Q. Muehlenbergii* and evidently a hybrid of these species, is growing near Bluffton, Wells County, Indiana.

× *Quercus Faxonii* Trel., with characters intermediate between those of *Quercus alba* and *Q. prinoides* and evidently a hybrid of these species, has been found in East Walpole, Norfolk County, and Concord, Middlesex County, Massachusetts, and at Greenville, Montcalm County, Michigan.

× *Quercus Fernowii* Trel., evidently a hybrid of *Quercus alba* and *Q. stellata*, has been found near Allenton, St. Louis County, Missouri, and on Red Clay Creek, Virginia.

× *Quercus Jackiana* Schn., evidently a hybrid of *Quercus alba* and *Q. bicolor*, is growing in Franklin Park, Boston.

× *Quercus Saulei* Schn., with characters intermediate between those of *Q. alba* and *Q. montana* and evidently a hybrid of these species, occurs with widely distributed individuals in Vermont (Monkton, Addison County), eastern Massachusetts, near Providence, Rhode Island, New Jersey, Eastern Pennsylvania, and the District of Columbia, on the Appalachian Mountains near Biltmore, Buncombe County, and Highlands, Macon County, North Carolina, at Valleyhead, Gadsden County, Alabama.

51. Quercus bicolor Willd. Swamp White Oak.

Quercus platanoides Sudw.

Leaves obovate to oblong-obovate, rounded at the narrowed apex, acute or rounded at the gradually narrowed and cuneate entire base, coarsely sinuate-dentate, or sometimes pinnatifid, with oblique rounded or acute entire lobes, when they unfold light bronze-green and pilose above, covered below with silvery white tomentum, with conspicuous glands on the teeth, at maturity thick and firm, dark green and lustrous on the upper surface, pale or often silvery white or tawny on the lower surface, 5′–6′ long, 2′–4′ wide, with a slender yellow midrib, primary veins running to the points of the lobes, and conspicuous

Fig. 278

reticulate veinlets; turning in the autumn dull yellow-brown or occasionally orange-color; petioles stout, pilose at first, becoming glabrous, $\frac{1}{2}$′–$\frac{3}{4}$′ in length. **Flowers:** staminate in hairy aments 3′–4′ long; calyx light yellow-green, hirsute with pale hairs, and deeply divided into 5–9 lanceolate acute segments rather shorter than the stamens; pistillate in few-flowered spikes on elongated peduncles covered like the involucral scales with thick white or tawny tomentum; stigmas bright red. **Fruit** usually in pairs on slender dark brown glabrous puberulous or pubescent stalks 1$\frac{1}{2}$′–4′ in length; nut ovoid, with a broad base, rounded, acute and pubescent at apex, light chestnut-brown, $\frac{3}{4}$′–1$\frac{1}{4}$′ long, $\frac{1}{2}$′–$\frac{3}{4}$′ thick, inclosed for about one third its length in the thick cup-shaped light brown cup pubescent on the inner surface, hoary-tomentose, and sometimes tuberculate or roughened toward the base on the outer surface by the thickened contorted tips of the ovate acute scales, thin, free, acute and chestnut-brown higher on the cup, and often forming a short fringe-like border on its margin, or sometimes entirely covered by thin scales with free acute tips.

A tree, usually 60°–70° or exceptionally 100° high, with a trunk 2°–3° or occasionally 8°–9° in diameter, rather small branches generally pendulous below and rising above into a narrow round-topped open head and often furnished with short pendulous laterals, and stout branchlets, green, lustrous, and slightly scurfy-pubescent when they first appear, light orange color or reddish brown and glabrous or puberulous during their first winter, becoming darker and often purplish and clothed with a glaucous bloom. **Winter-buds** broadly ovoid and obtuse, or subglobose to ovoid and acute, $\frac{1}{8}$′ long, with light chestnut-brown scales usually pilose above the middle. **Bark** of young stems and small branches smooth, reddish or purplish brown, separating freely into large papery persistent scales curling back and displaying the bright green inner bark; becoming on old trunks 1′–2′

thick, and deeply and irregularly divided by continuous or interrupted fissures into broad flat ridges covered by small appressed gray-brown scales often slightly tinged with red. **Wood** heavy, hard, strong, tough, light brown, with thin hardly distinguishable sapwood; used in construction, the interior finish of houses, cabinet-making, carriage and boat-building, cooperage, and railway-ties, and for fencing and fuel.

Distribution. Borders of streams and swamps in moist fertile soil; southern Maine to northern Vermont and southwestern Quebec, through Ontario and the southern peninsula of Michigan to southeastern Minnesota, eastern and southern Iowa, southeastern Nebraska and western Missouri, and to the District of Columbia, northern Kentucky and northeastern Oklahoma, and along the Appalachian Mountains to West Virginia; widely scattered, usually in small groves but nowhere very abundant; most common and of its largest size in western New York and northern Ohio.

× *Quercus Schuettii* Trel., with characters intermediate between those of *Quercus bicolor* and *Q. macrocarpa*, and probably a hybrid of these species, occurs at Fort Howard, Brown County, Wisconsin, near Rockfield and Chateaugay, Quebec, and near Rochester and Golah, Monroe County, New York.

52. Quercus Prinus L. Basket Oak. Cow Oak.

Quercus Michauxii Nutt.

Leaves broadly obovate to oblong-obovate, acute or acuminate at apex with a short broad point, cuneate or rounded at the broad or narrow entire base, regularly crenately lobed with oblique rounded entire lobes sometimes furnished with glandular tips, or

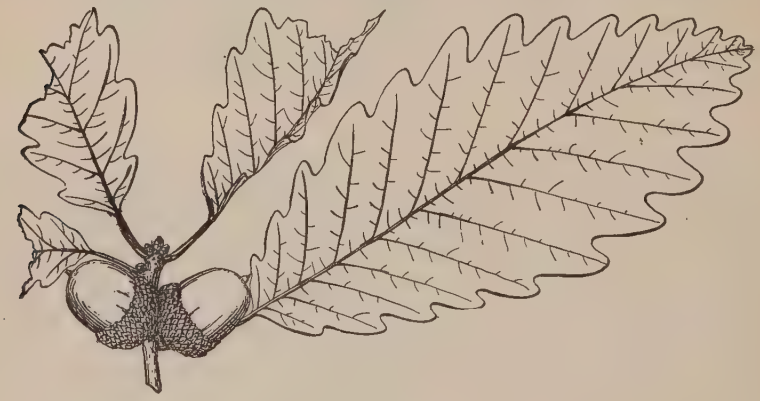

Fig. 279

rarely entire with undulate margins, when they unfold bright yellow-green, lustrous and pubescent above, coated below with thick silvery white or ferrugineous tomentum, at maturity thick and firm or sometimes membranaceous, especially on young and vigorous branches, dark green, lustrous, glabrous or occasionally roughened by scattered fascicled hairs on the upper surface, more or less densely pubescent on the pale green or silvery white lower surface, 6′–8′ long, 3′–5′ wide; turning in the autumn dark rich crimson; petioles stout, ½′–1½′ in length. **Flowers:** staminate in slender hairy aments, 3′–4′ long; calyx light yellow-green, pilose with long pale hairs, and divided into 4–7 acute lobes; pistillate in few-flowered spikes on short peduncles coated like the involucral scales with dense pale rufous tomentum; stigmas dark red. **Fruit** solitary or in pairs, sessile or subsessile, or borne on short stout puberulous stalks rarely ½′ in length; nut ovoid to ellipsoidal, with a broad

base, and acute, rounded, or occasionally truncate at apex surrounded by a narrow ring of rusty pubescence, or sometimes pilose nearly to the middle, bright brown, rather lustrous, 1′–1½′ long, ¾′–1¼′ thick, inclosed for about one third its length in the thick cup-shaped cup often broad and flat on the bottom, reddish brown and pubescent within, hoary-tomentose and covered on the outer surface by regularly imbricated ovate acute scales rounded and much thickened on the back, their short tips sometimes forming a rigid fringe-like border to the rim of the cup; **seed** sweet and edible.

A tree, often 100° high, with a trunk sometimes free of branches for 40°–50°, and 3°–7° in diameter, stout branches ascending at narrow angles and forming a round-topped rather compact head, and stout branchlets at first dark green and covered by pale caducous hairs, becoming bright red-brown or light orange-brown during their first winter and ultimately ashy gray. **Winter-buds** broadly ovoid or oval, acute, ¼′ long, with thin closely and regularly imbricated dark red puberulous scales with pale margins, those of the inner ranks coated on the outer surface with loose pale tomentum. **Bark** ½′–1′ thick, separating into thin closely appressed silvery white or ashy gray scales more or less deeply tinged with red. **Wood** heavy, hard, very strong, tough, close-grained, durable, easy to split, light-brown, with thin darker colored sapwood; largely used in all kinds of construction, for agricultural implements, wheels, in cooperage, for fences and fuel, and in baskets.

Distribution. Borders of streams, swamps, and bottom-lands often covered with water; New Jersey (Morristown, Morris County and Pittsgrove, Salem County), near Wilmington, Delaware, southward through the coast and middle districts to Putnam (San Mateo) and Citrus Counties, Florida, through the Gulf states to the valley of the Trinity River, Texas, and through Arkansas and southeastern Missouri to central Tennessee and Kentucky, the valley of the lower Wabash River, Illinois, and southern Indiana eastward to Jefferson County (*C. C. Deam*); conspicuous from the silvery white bark, the massive trunk, and the broad crown of large bright-colored foliage.

53. Quercus montana Willd. Chestnut Oak. Rock Chestnut Oak.

Quercus Prinus Engelm., not L.

Leaves obovate or oblong to lanceolate, acute or acuminate or rounded at apex, gradually or abruptly cuneate or rounded or subcordate at the narrow entire base, irregularly and coarsely crenulate-toothed with rounded, acute, or sometimes nearly triangular oblique teeth, when they unfold orange-green or bronze-red, very lustrous, and glabrous above with the exception of the slightly pilose midrib, green and coated below with soft pale pubescence, at maturity thick and firm or subcoriaceous, yellow-green and rather lustrous on the upper surface, paler and covered by fine pubescence on the lower surface, 4½′–9′ long, 1½′–3′ wide, with a stout yellow midrib and conspicuous primary veins, often much broader near the bottom of the tree than on fertile upper branches; turning dull orange color or rusty brown in the autumn; petioles stout or slender, ½′–1′ in length. **Flowers:** staminate in elongated hirsute aments; calyx light yellow, pilose and deeply divided into 7–9 acute segments tipped with clusters of pale hairs; pistillate in short spikes on stout puberulous dark green peduncles, their involucral scales covered with pale hairs: stigmas dark red. **Fruit** on short stout stems singly or in pairs; nut ovoid or ellipsoidal, rounded and rather obtuse or pointed at apex, bright chestnut-brown, very lustrous, 1′–1½′ long, ⅝′–1′ thick, inclosed for about half its length or sometimes only at the base in a turbinate or cup-shaped thin cup light brown and pubescent on the inner surface, reddish brown and hoary-pubescent on the outer surface roughened or tuberculate, especially toward the base, by small scales thickened and knob-like with nearly triangular free light brown tips.

A tree, usually 60°–70° or occasionally 100° high, with a trunk 3°–4° or rarely 6°–7° in diameter, divided generally 15° or 20° above the ground into large limbs spreading into a broad open rather irregular head, and stout branchlets green tinged with purple or bronze color and glabrous or pilose when they first appear, light orange color or reddish brown during their first winter, becoming dark gray or brown; on dry exposed mountain slopes

often not more than 20°–30° tall, with a trunk 8′–12′ in diameter. **Winter-buds** ovoid, acute or acuminate, $\frac{1}{4}$′–$\frac{1}{2}$′ long, with bright chestnut-brown scales pilose toward the apex and ciliate on the margins. **Bark** of young stems and small branches thin, smooth, purplish brown, often lustrous, becoming on old trunks and large limbs $\frac{3}{4}$′–$1\frac{1}{2}$′ thick, dark reddish brown or nearly black, and divided into broad rounded ridges covered with small closely appressed scales. **Wood** heavy, hard, strong, rather tough, close-grained, durable in contact with the soil, largely used for fencing, railway-ties, and fuel. The bark, which is rich in tannin, is consumed in large quantities in tanning leather.

Distribution. Hillsides and the high rocky banks of streams in rich and deep or sometimes in sterile soil; coast of southern Maine, southern New Hampshire and eastern Massachusetts, southward to Delaware and the District of Columbia, and along the Appalachian

Fig. 280

Mountains and their foothills to northern Georgia (Wilkes County); ascending to altitudes of 4000°–4500°; in Alabama to Perry and Hale Counties; westward to the shores of Lake Champlain, western New York; southeastern and southern Ohio, and southern Indiana westward to Orange County (*C. C. Deam*) and on hills near Elberfeld, Warrick County; and to central Kentucky and Tennessee, and northeastern Mississippi (Alcorn, Prentiss and Tishomingo Counties); rare and local in New England and Ontario; abundant on the banks of the lower Hudson River and on the Appalachian hills from southern New York to Alabama; most common and of its largest size on the lower slopes of the mountains of the Carolinas and Tennessee, here often forming a large part of the forest.

× *Quercus Sargentii* Rehd. believed to be a hybrid of *Quercus montana* and the European *Q. robur* L., has been growing for nearly a hundred years at what is now Holm Lea, Brookline, Norfolk County, Massachusetts.

54. Quercus Muehlenbergii Engelm. Yellow Oak. Chestnut Oak.

Quercus acuminata Sarg.

Leaves usually crowded at the ends of the branches, oblong-lanceolate to broadly obovate, acute or acuminate with a long narrow or with a short broad point, abruptly or gradually narrowed and cuneate or slightly narrowed and rounded or cordate at base, equally serrate with acute and often incurved or broad and rounded teeth tipped with small glandular mucros, or rarely slightly undulate, when they unfold bright bronzy green and puberulous above, tinged with purple and coated below with pale tomentum, at

maturity thick and firm, light yellow-green on the upper surface, pale often silvery white and covered with short fine pubescence on the lower surface, 4′–7′ long, 1′–5′ wide, with a stout yellow midrib and conspicuous primary veins running to the points of the teeth; turning in the autumn orange color and scarlet; petioles slender $\frac{3}{4}$′–1$\frac{1}{2}$′ in length. **Flowers:** staminate in pilose aments 3′–4′ long; calyx light yellow, hairy, deeply divided into 5 or 6 lanceolate ciliate segments; pistillate sessile or in short spikes coated like their involucral scales with thick white tomentum; stigmas bright red. **Fruit** sessile or raised on a short stout peduncle, solitary or often in pairs; nut broadly ovoid, narrowed and rounded at apex, $\frac{1}{2}$′ to nearly 1′ long, light chestnut-brown, inclosed for about half its length in a thin cup-shaped light brown cup pubescent on the inner, hoary-tomentose on the outer surface, and covered by small obtuse scales more or less thickened and rounded on the back toward the base of the cup, the small free red-brown tips of the upper ranks forming a minute fringe-like border to its rim; **seed** sweet and sometimes edible.

Fig. 281

A tree, 80°–100°, occasionally 160° high, with a tall straight trunk 3°–4° in diameter above the broad and often buttressed base, comparatively small branches forming a narrow shapely round-topped head, and slender branchlets, green more or less tinged with red or purple, pilose when they first appear, light orange color or reddish brown during their first winter, and ultimately gray or brown; east of the Alleghany Mountains and on dry hills often not more than 20°–30° tall. **Winter-buds** ovoid, acute, $\frac{1}{8}$′–$\frac{1}{4}$′ long, with chestnut-brown scales white and scarious on the margins. **Bark** rarely $\frac{1}{2}$′ thick, broken on the surface into thin loose silvery white scales sometimes slightly tinged with brown. **Wood** heavy, very hard, strong, close-grained, durable, with thin light-colored sapwood; largely used in cooperage, for wheels, fencing, and railway-ties.

Distribution. Gardner's Island, Lake Champlain, Vermont, western Massachusetts and Connecticut, near Newberg, Orange County, New York, westward through New York, southern Ontario and southern Michigan and western Wisconsin to northern Iowa, southeastern Nebraska, eastern Kansas, and Oklahoma to the valley of the Washita River (Garvin County) and to the Devil's Cañon near Hinton (Caddo County) and southward in the Atlantic states to the District of Columbia, eastern Virginia; sparingly on the eastern foothills of the Blue Ridge in North and South Carolina at altitudes between 1000° and 2000°; in central Tennessee and Kentucky, central and northeastern Georgia, western Florida, and through the Gulf states to the valley of the Guadalupe River, Texas; on the Guadalupe Mountains, Texas, and on the Capitan Mountains, New Mexico (Lincoln County); rare and comparatively local in the Atlantic states, usually on limestone soil; very abundant in the Mississippi basin, growing on ridges, dry flinty hills, deep rich bottom-lands and the

rocky banks of streams; probably of its largest size on the lower Wabash River and its tributaries in southern Indiana and Illinois; on the Edwards Plateau (Kemble, Kerr, Uvalde, Bandera and Real Counties), Texas, a form occurs with nuts sometimes $1\frac{1}{4}'$ long with deeper cups up to 1′ in diameter (var. *Brayi* Sarg.).

Section 2. Flowers unisexual (*usually perfect in Ulmus*); calyx regular; stamens as many as its lobes and opposite them; ovary superior, 1-celled (*rarely 2-celled in Ulmus*); seed 1.

XI. ULMACEÆ.

Trees, with watery juice, scaly buds, terete branchlets prolonged by an upper lateral bud, and alternate simple serrate pinnately veined deciduous stalked 2-ranked leaves unequal and often oblique at base, conduplicate in the bud, their stipules usually fugaceous. Flowers perfect or monœciously polygamous, clustered, or the pistillate sometimes solitary; calyx 4–9-parted or lobed; stamens 4–6; filaments straight; anthers introrse, 2-celled, opening longitudinally; ovary usually 1-celled; ovule solitary, suspended from the apex of the cell, anatropous or amphitropous; styles 2. Fruit a samara, nut, or drupe; albumen little or none; embryo straight or curved; cotyledons usually flat or conduplicate. Five of the thirteen genera of the Elm family occur in North America. Of these four are represented by trees.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT GENERA.

Fruit a dry samara, or nut-like.	
Flowers perfect; fruit a samara.	1. Ulmus.
Flowers polygamo-monœcious; fruit nut-like, tuberculate.	2. Planera.
Fruit drupaceous.	
Pistillate flowers usually solitary.	3. Celtis.
Pistillate flowers in dichotomous cymes.	4. Trema.

1. ULMUS L. Elm.

Trees, or rarely shrubs, with deeply furrowed bark, branchlets often furnished with corky wings, and buds with numerous ovate rounded chestnut-brown scales closely imbricated in two ranks, increasing in size from without inward, the inner accrescent, replacing the stipules of the first leaves, deciduous, marking the base of the branchlet with persistent ring-like scars. Leaves simply or doubly serrate; stipules linear, lanceolate to obovate, entire, free or connate at base, scarious, inclosing the leaf in the bud, caducous. Flowers from axillary buds near the ends of the branches similar to but larger than the leaf-buds, the outer scales sterile, the inner bearing flowers and rarely leaves. Flowers perfect, jointed on slender bibracteolate pedicels from the axils of linear acute scarious bracts, in pedunculate or subsessile fascicles or cymes sometimes becoming racemose, appearing in early spring before the leaves in the axils of those of the previous year, or autumnal in the axils of leaves of the year; calyx campanulate, 5–9-lobed, membranaceous, marcescent; stamens 5 or 6 inserted under the ovary; filaments filiform or slightly flattened, erect in the bud, becoming exserted; anthers oblong, emarginate, and subcordate; ovary sessile or stipitate, compressed, crowned by a simple deeply 2-lobed style, the spreading lobes papillo-stigmatic on the inner face, usually 1-celled by abortion, rarely 2-celled; ovule amphitropous; micropyle extrorse, superior. Fruit an ovoid or oblong, often oblique, sessile or stipitate samara surrounded at base by the remnants of the calyx, the seminal cavity compressed, slightly thickened on the margin, chartaceous, produced into a thin reticulate-venulose membranaceous light brown broad or rarely narrow wing naked or ciliate on the margin, tipped with the remnants of the persistent style, or more or

less deeply notched at apex, and often marked by the thickened line of the union of the two carpels. Seed ovoid, compressed, without albumen, marked on the ventral edge by the thin raphe; testa membranaceous, light or dark chestnut-brown, of two coats, rarely produced into a narrow wing; embryo erect; cotyledons flat or slightly convex, much longer than the superior radicle turned toward the oblong linear pale hilum.

Ulmus, with eighteen or twenty species, is widely distributed through the boreal and temperate regions of the northern hemisphere with the exception of western North America, reaching in the New World the mountains of southern Mexico and in the Old World the Sikkim Himalaya, western China, and Japan. Of the exotic species, *Ulmus procera* Salisb., the so-called English Elm, and *Ulmus glabra*, Huds., the Scotch Elm, and several of its varieties, have been largely planted for shade and ornament in the north Atlantic states, where old and large specimens of the former can be seen, especially in the neighborhood of Boston.

Ulmus produces heavy, hard, tough, light-colored wood, often difficult to split. The tough inner bark of some of the species is made into ropes or woven into coarse cloth, and in northern China nourishing mucilaginous food is prepared from the inner bark.

Ulmus is the classical name of the Elm-tree.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Flowers vernal, appearing before the leaves.

Flowers on slender drooping pedicels; fruit ciliate on the margins.

Wing of the fruit broad.

Bud-scales and fruit glabrous; branchlets destitute of corky wings; leaves obovate-oblong to elliptic, usually smooth on the upper, soft-pubescent on the lower surface. 1. **U. americana** (A, C).

Bud-scales puberulous; branches often furnished with corky wings; fruit hirsute; leaves obovate to oblong, smooth on the upper, soft-pubescent on the lower surface. 2. **U. racemosa** (A).

Wing of the fruit narrow; bud-scales glabrous or slightly puberulous; branchlets usually furnished with broad corky wings; fruit hirsute, leaves ovate-oblong to oblong-lanceolate, smooth on the upper, soft-pubescent on the lower surface. 3. **U. alata** (A, C).

Flowers on short pedicels; fruit naked on the margins; bud-scales coated with rusty hairs; fruit pubescent; leaves ovate-oblong, scabrous on the upper, pubescent on the lower surface. 4. **U. fulva** (A, C).

Flowers autumnal, appearing in the axils of leaves of the year; branchlets furnished with corky wings; fruit hirsute.

Bud-scales puberulous; flowers on short pedicels; leaves ovate, scabrous on the upper, soft-pubescent on the lower surface. 5. **U. crassifolia** (C).

Bud-scales glabrous; flowers on long pedicels; leaves oblong to oblong-obovate, acuminate, glabrous on the upper, pale and puberulous on the lower surface. 6. **U. serotina** (C).

1. Ulmus americana L. White Elm.

Ulmus floridana Chapm.

Leaves obovate-oblong to elliptic, abruptly narrowed at apex into a long point, full and rounded at base on one side and shorter and cuneate on the other, coarsely doubly serrate with slightly incurved teeth, when they unfold coated below with pale pubescence and pilose above with long scattered white hairs, at maturity 4′–6′ long, 1′–3′ wide, dark green and glabrous or scarbate above, pale and soft-pubescent or sometimes glabrous below, with a narrow pale midrib and numerous slender straight primary veins running to the points of the teeth and connected by fine cross veinlets; turning bright clear yellow in the autumn before falling; petioles stout, ¼′ in length; stipules linear-lanceolate, ½′–2′ long. **Flowers** on long slender drooping pedicels sometimes 1′ in length, in 3 or 4-flowered short-

stalked fascicles; calyx irregularly divided into 7–9 rounded lobes ciliate on the margins, often somewhat oblique, puberulous on the outer surface, green tinged with red above the middle; anthers bright red; ovary light green, ciliate on the margins with long white hairs; styles light green. **Fruit** on long pedicels in crowded clusters, ripening as the leaves unfold, ovoid to obovoid-oblong, slightly stipitate, conspicuously reticulate-venulose, $\frac{1}{2}'$ long, ciliate on the margins, the sharp points of the wings incurved and inclosing the deep notch.

A tree, sometimes 100°–120° high, with a tall trunk 6°–11° in diameter, frequently enlarged at the base by great buttresses, occasionally rising with a straight undivided shaft to the height of 60°–80° and separating into short spreading branches, more commonly divided 30°–40° from the ground into numerous upright limbs gradually spreading and forming an inversely conic round-topped head of long graceful branches, often 100° or rarely 150° in diameter, and slender branchlets frequently fringing the trunk and its principal divisions, light green and coated at first with soft pale pubescence, becoming in their first winter light reddish brown, glabrous or sometimes puberulous and marked by scat-

Fig. 282

tered pale lenticels, and by large elevated semiorbicular leaf-scars showing the ends of three large equidistant fibro-vascular bundles, later becoming dark reddish brown and finally ashy gray. **Winter-buds** ovoid, acute, slightly flattened, about $\frac{1}{8}'$ long, with broadly ovate rounded light chestnut-brown glabrous scales, the inner bright green, ovate, acute, becoming on vigorous shoots often nearly 1′ in length. **Bark** 1′–$1\frac{1}{2}'$ thick, ashy gray, divided by deep fissures into broad ridges separating on the surface into thin appressed scales. **Wood** heavy, hard, strong, tough, difficult to split, coarse-grained, light brown, with thick somewhat lighter colored sapwood; largely used for the hubs of wheels, saddle-trees, in flooring and cooperage, and in boat and shipbuilding.

Distribution. River-bottom lands, intervales, low rich hills, and the banks of streams; southern Newfoundland to the northern shores of Lake Superior and the headwaters of the Saskatchewan, southward to the neighborhood of Lake Istokpoga, De Soto County, Florida, westward in the United States to the Turtle Mountains of North Dakota, the Black Hills of South Dakota, western Nebraska, central Kansas and Oklahoma, and the valley of the upper Colorado River (Fort Chadbourne, Coke County), Texas; very common northward, less abundant and of smaller size southward; abundant on the banks of streams flowing through the midcontinental plateau.

Largely planted as an ornamental and shade tree in the northern states, and rarely in western and northern Europe.

2. Ulmus racemosa Thomas. Rock Elm. Cork Elm.

Ulmus Thomasii Sarg.

Leaves obovate to oblong-oval, rather abruptly narrowed at apex into a short broad point, equally or somewhat unequally rounded, cuneate or subcordate at base, and coarsely doubly serrate, when they unfold pilose on the upper surface and covered on the lower with soft white hairs, at maturity 2′–2½′ long, ¾′–1′ wide, thick and firm, smooth, dark green and lustrous above, paler and soft-pubescent below, especially on the stout midrib and the numerous straight veins running to the point of the teeth and connected by obscure cross veinlets; turning in the autumn bright clear yellow; petioles pubescent, about ¼′ in length; stipules ovate-lanceolate, conspicuously veined, light green, marked with dark red on the margins above the middle, ⅔′ long, clasping the stem by their abruptly enlarged cordate base conspicuously dentate with 1–3 prominent teeth on each side, falling when the leaves are half grown. **Flowers** on elongated slender drooping pedicels often ½′ long, in 2–4, usu-

Fig. 283

ally in 3 flowered, puberulous cymes becoming more or less racemose by the lengthening of the axis of the inflorescence, and when fully grown sometimes 2′ in length; calyx green, divided nearly to the middle into 7 or 8 rounded dark red scarious lobes; anthers dark purple; ovary coated with long pale hairs most abundant on the margins; styles light green. **Fruit** ripening when the leaves are about half grown, ovoid or obovoid-oblong, ½′ long, with a shallow open notch at the apex, obscurely veined, pale pubescent, ciliate on the slightly thickened border of the broad wing, the margin of the seminal cavity scarcely thickened.

A tree, 80°–100° high, with a trunk occasionally 3° in diameter, and often free of branches for 60°, short stout spreading branches forming a narrow round-topped head, and slender rigid branchlets, light brown when they first appear, and coated with soft pale pubescence often persistent until their second season, becoming light reddish brown, puberulous or glabrous and lustrous in their first winter, and marked by scattered oblong lenticels and large orbicular or semiorbicular leaf-scars displaying an irregular row of 4–6 fibro-vascular bundle-scars, ultimately dark brown or ashy gray, and usually furnished with 3 or 4 thick corky irregular wings often ½′ broad, and beginning to appear in their first or more often during their second year. **Winter-buds** ovoid, acute, ¼′ long, with broadly ovate rounded chestnut-brown scales pilose on the outer surface, ciliate on the margins, the inner scales becoming ovate-oblong to lanceolate, and ½′ long, often dentate at the base, with 1 or 2 minute teeth on each side, bright green below the middle, marked with a red blotch above, and white and scarious at the apex. **Bark** ¾′–1′ thick, gray tinged with red, and deeply

divided by wide irregular interrupted fissures into broad flat ridges broken on the surface into large irregularly shaped scales. **Wood** heavy, hard, very strong and tough, close-grained, light clear brown often tinged with red, with thick lighter colored sapwood; largely employed in the manufacture of many agricultural implements, for the framework of chairs, hubs of wheels, railway-ties, the sills of buildings, and other purposes demanding toughness, solidity and flexibility.

Distribution. Dry gravelly uplands, low heavy clay soils, rocky slopes and river cliffs; Province of Quebec westward through Ontario, the southern peninsula of Michigan and central Wisconsin to northeastern Nebraska, western Missouri and eastern Kansas, and southward to northern New Hampshire, southern Vermont, western New York, (valley of the Genessee River), northern New Jersey, southern Ohio (near Columbus, Franklin County), and central Indiana; rare in the east and toward the extreme western and southern limits of its range.

Occasionally planted as a shade and ornamental tree in the northern states.

3. Ulmus alata Michx. Wahoo. Winged Elm.

Leaves ovate-oblong to oblong-lanceolate, often somewhat falcate, acute or acuminate, unequally cuneate or rounded or subcordate at base, and coarsely doubly serrate with

Fig. 284

incurved teeth, when they unfold pale green often tinged with red, coated on the lower surface with soft white pubescence and glabrous or nearly so on the upper surface, at maturity thick and firm or subcoriaceous, dark green and smooth above, pale and soft-pubescent below, especially on the stout yellow midrib and numerous straight prominent veins often forked near the margins of the leaf and connected by rather conspicuous reticulate veinlets; turning yellow in the autumn; their petioles stout, pubescent, $\frac{1}{3}'$ in length; stipules linear-obovate, thin and scarious, tinged with red above the middle, often nearly 1′ long. **Flowers** on drooping pedicels, in short few-flowered fascicles; calyx glabrous and divided nearly to the middle into 5 broad ovate rounded lobes as long as the hoary-tomentose ovary raised on a short slender stipe. **Fruit** ripening before or with the unfolding of the leaves, oblong, $\frac{1}{3}'$ in length, contracted at base into a long slender stalk, gradually narrowed and tipped at apex with long incurved awns, and covered with long white hairs most numerous on the thickened margin of the narrow wing; **seed** ovoid, pointed, $\frac{1}{8}'$ long, pale, chestnut-brown, slightly thickened into a narrow wing-like margin.

A tree, occasionally 80°–100° but usually not more than 40°–50° high, with a trunk 2°–3° in diameter, short stout straight or erect branches forming a narrow oblong rather open

round-topped head, and slender branchlets glabrous or puberulous and light green tinged with red when they first appear, becoming light reddish brown or ashy gray and glabrous, or on vigorous individuals frequently pilose in their first winter, marked by occasional small orange-colored lenticels and by small elevated horizontal semiorbicular leaf-scars, sometimes naked, more often furnished with usually 2 thin corky wings beginning to grow during their first or more often during their second season, abruptly arrested at the nodes, often $\frac{1}{2}'$ wide, and persistent for many years. **Winter-buds** slender, acute, $\frac{1}{8}'$ long, dark chestnut-brown, with glabrous or puberulous scales, those of the inner ranks becoming oblong or obovate, rounded and tipped with a minute mucro, thin and scarious, light red, especially above the middle, and $\frac{1}{2}'$ long. **Bark** rarely exceeding $\frac{1}{4}'$ in thickness, light brown tinged with red, and divided by irregular shallow fissures into flat ridges covered by small closely appressed scales. **Wood** heavy, hard, not strong, close-grained, difficult to split, light brown, with thick lighter colored sapwood; sometimes employed for the hubs of wheels and the handles of tools. Ropes used for fastening the covers of cotton bales are sometimes made from the inner bark.

Distribution. Usually on dry gravelly uplands, less commonly in alluvial soil on the borders of swamps and the banks of streams, and occasionally in inundated swamps; southeastern Virginia, southwestern Indiana, southern Illinois (Richland and Johnson Counties) and southern Missouri, and southward to central Florida (Lake County), and the valley of the Guadalupe River, Texas; ranging westward in Oklahoma to Garfield County (near Kingfisher, *G. W. Stevens*).

Often planted as a shade-tree in the streets of towns and villages of the southern states.

4. Ulmus fulva Michx. Slippery Elm. Red Elm.

Leaves ovate-oblong, abruptly contracted into a long slender point, rounded at base on one side and short-oblique on the other, and coarsely doubly serrate with incurved

Fig. 285

callous-tipped teeth, when they unfold thin, coated below with pale pubescence, pilose above with scattered white hairs, at maturity thick and firm, dark green and rugose with crowded sharp-pointed tubercles pointing toward the apex of the leaf above, soft, smooth, and coated below, especially on the thin midrib and in the axils of the slender straight veins with white hairs, 5′–7′ long, 2′–3′ wide; turning a dull yellow color in the autumn; petioles stout, pubescent, $\frac{1}{3}'$ in length; stipules obovate-oblong to oblong-lanceolate, thin and scarious, pale-pubescent, and tipped with clusters of rusty brown hairs. **Flowers** on short pedicels, in crowded fascicles; calyx green, covered with pale hairs, divided into 5–9

short rounded thin equal lobes; stamens with slender light yellow slightly flattened filaments and dark red anthers; stigmas slightly exserted, reddish purple, papillose with soft white hairs. **Fruit** ripening when the leaves are about half grown, semiorbicular, rounded and bearing the remnants of the styles or slightly emarginate at apex, rounded or cuneate at base, $\frac{1}{2}'$ broad, the seminal cavity coated with thick rusty brown tomentum, the broad thin wing obscurely reticulate-veined, naked on the thickened margin, and marked by the dark conspicuous horizontal line of union of the two carpels; **seed** ovoid, with a large oblique pale hilum, a light chestnut-brown coat produced into a thin border wider below than above the middle of the seed.

A tree, 60°–70° high, with a trunk occasionally 2° in diameter, spreading branches forming a broad open flat-topped head, and stout branchlets bright green, scabrate, and coated with soft pale pubescence when they first appear, becoming light brown by midsummer, often roughened by small pale lenticels, and in their first winter ashy gray, orange color or light red-brown, and marked by large elevated semiorbicular leaf-scars showing the ends of 3 conspicuous equidistant fibro-vascular bundles, ultimately dark gray or brown. **Winter-buds** ovoid, obtuse, $\frac{1}{4}'$ long, with about 12 scales, the outer broadly ovate, rounded, dark chestnut-brown, and covered by long scattered rusty hairs, the inner when fully grown $\frac{1}{2}'$ long, $\frac{1}{8}'$–$\frac{1}{4}'$ wide, light green, strap-shaped, rounded and tipped at the apex with tufts of rusty hairs, puberulous on the outer surface, slightly ciliate on the margins, gradually growing narrower and passing into the stipules of the upper leaves. **Bark** frequently 1′ thick, dark brown tinged with red, divided by shallow fissures and covered by large thick appressed scales. **Wood** heavy, hard, strong, very close-grained, durable, easy to split, dark brown or red, with thin lighter colored sapwood; largely used for fence-posts, railway-ties, the sills of buildings, the hubs of wheels, and in agricultural implements. The thick fragrant inner bark is mucilaginous and demulcent, and is employed in the treatment of acute febrile and inflammatory affections.

Distribution. Banks of streams and low rocky hillsides in deep rich soil; comparatively common in the valley of the St. Lawrence River, Province of Quebec, and through Ontario to northern and eastern South Dakota, northeastern and eastern Nebraska, southeastern Kansas, and Oklahoma to the valley of the Canadian River (McClain County), and southward to western Florida, central Alabama and Mississippi, western Louisiana and the valley of the upper Guadalupe (Kerr County) and Leon Rivers (Comal County), Texas; in the South Atlantic states not common and mostly confined to the middle districts, ascending to altitudes of 2000° on the southern Appalachian foothills.

5. Ulmus crassifolia Nutt. Cedar Elm.

Leaves elliptic to ovate, acute or rounded at apex, unequally rounded or cuneate and often oblique at base, coarsely and unequally doubly serrate with callous-tipped teeth, when they unfold thin, light green tinged with red, pilose above and covered below with soft pale pubescence, at maturity thick and subcoriaceous, dark green, lustrous and roughened by crowded minute sharp-pointed tubercles on the upper surface and soft pubescent on the lower surface, 1′–2′ long, $\frac{1}{2}'$–1′ wide, with a stout yellow midrib, and prominent straight veins connected by conspicuous more or less reticulate cross veinlets; usually turning bright yellow late in the autumn; petioles stout, tomentose, $\frac{1}{4}'$–$\frac{1}{2}'$ in length; stipules $\frac{1}{2}'$ long, linear-lanceolate, red and scarious above, clasping the stem by their green and hairy bases, deciduous when the leaves are about half grown. **Flowers** usually opening in August and sometimes also in October, on slender pedicels $\frac{1}{3}'$–$\frac{1}{2}'$ long and covered with white hairs, in 3–5-flowered pedunculate fascicles; calyx divided to below the middle into oblong pointed lobes hairy at base; ovary hirsute, crowned with two short slightly exserted stigmas. **Fruit** ripening in September and rarely also in November, oblong, gradually and often irregularly narrowed from the middle to the ends, short-stalked, deeply notched at apex, $\frac{1}{3}'$ to nearly $\frac{1}{2}'$ long, covered with soft white hairs, most abundant on the slightly thickened margin of the broad wing; **seed** oblique, pointed, and covered by a dark chestnut-brown coat.

A tree, often 80° high, with a tall straight trunk 2°–3° in diameter, sometimes free of

branches for 30° or 40°, divided into numerous stout spreading limbs forming a broad inversely conic round-topped head of long pendulous branches, or while young or on dry uplands a compact round head of drooping branches, and slender branchlets, tinged with red and coated with soft pale pubescence when they first appear, becoming light reddish brown, puberulous and marked by scattered minute lenticels and by small elevated semi-orbicular leaf-scars showing the ends of 3 small fibro-vascular bundles, and furnished with 2 corky wings covered with lustrous brown bark, about $\frac{1}{4}'$ broad and continuous except when abruptly interrupted by lateral branchlets, or often irregularly developed. **Winter-buds** broadly ovoid, acute, $\frac{1}{8}'$ long, with closely imbricated chestnut-brown scales slightly puberu-

Fig. 286

lous on the outer surface, those of the inner ranks at maturity oblong, concave, rounded at apex, thin, bright red, sometimes $\frac{3}{4}'$ long. **Bark** sometimes nearly 1′ thick, light brown slightly tinged with red, and deeply divided by interrupted fissures into broad flat ridges broken on the surface into thick scales. **Wood** heavy, hard, strong, brittle, light brown tinged with red, with thick lighter colored sapwood; in central Texas used in the manufacture of the hubs of wheels, for furniture, and largely for fencing.

Distribution. Valley of the Sunflower River, Mississippi (Moorhead, Sunflower County), and western Louisiana (very common in Rayville, Natchitoches Parish (*R. S. Cocks*), through southern Arkansas, and Texas to Nuevo Leon, ranging in western Texas from the coast to the valley of the Pecos River; in Arkansas usually on river cliffs and low hillsides, and in Texas near streams in deep alluvial soil and on dry limestone hills; the common Elm-tree of Texas and of its largest size on the bottom-lands of the Guadalupe and Trinity Rivers.

Occasionally planted as a shade-tree in the streets of the cities and towns of Texas.

6. Ulmus serotina Sarg. Red Elm.

Leaves oblong to oblong-obovate, acuminate, very oblique at base, coarsely and doubly crenulate-serrate, when they unfold coated below with shining white hairs and puberulous above, at maturity thin and firm in texture, yellow-green, glabrous and lustrous on the upper surface, pale and puberulous on the midrib and principal veins below, 2′–4′ long, 1′–$1\frac{3}{4}'$ wide, with a prominent yellow midrib, about 20 pairs of primary veins extending obliquely to the points of the teeth and often forked near the margins of the leaf, and numerous reticular veinlets; turning clear orange-yellow in the autumn; petioles stout, about $\frac{1}{4}'$ in length; stipules abruptly narrowed from broad clasping bases, linear-lanceolate, usually about $\frac{1}{4}'$ long, persistent until the leaves are nearly fully grown. **Flowers** opening in

September on slender conspicuously jointed pedicels often $\frac{1}{8}'$ long, in many-flowered glabrous racemes from $1'$–$1\frac{1}{2}'$ in length; calyx 6-parted to the base, with oblong-obovate red-brown divisions rounded at apex; ovary sessile, narrowed below, villose. **Fruit** ripening early in November, stipitate, oblong-elliptic, deeply divided at apex, fringed on the margins with long silvery white hairs, about $\frac{1}{2}'$ long.

A tree, 50°–60° high, with a trunk 2°–3° in diameter, comparatively small spreading or pendulous branches often forming a broad handsome head, and slender pendulous branchlets glabrous or occasionally puberulous when they first appear, brown, lustrous, and marked by occasional oblong white lenticels during their first year, becoming darker

Fig. 287

the following season and ultimately dark gray-brown, and often furnished with 2 or 3 thick corky wings developed during their second or third years. **Winter-buds** ovoid, acute, $\frac{1}{4}'$ long, their outer scales oblong-obovate, dark chestnut-brown, glabrous, the inner often scarious on the margins, pale yellow-green, lustrous and sometimes $\frac{3}{4}'$ long when fully grown. **Bark** $\frac{1}{4}'$–$\frac{3}{8}'$ thick, light brown slightly tinged with red, and divided by shallow fissures into broad flat ridges broken on the surface into large thin closely appressed scales. **Wood** hard, close-grained, very strong and tough, light red-brown, with pale yellow sapwood.

Distribution. Limestone hills and river banks; rare and local; eastern (near Pikeville, Pike County) and southern Kentucky (Bowling Green, Warren County); banks of the Cumberland River, near Clarksville and Nashville, Tennessee; northeastern Georgia (cliffs of the Coosa River, near Rome, Floyd County); northern Alabama (Madison, Jefferson and Tuscaloosa Counties); valley of the Arkansas River (near Van Buren, Crawford County, *G. M. Brown*) and northwestern Arkansas (Sulphur Springs, Benton County, and Boston Mountains near Jasper, Newton County, *E. J. Palmer*); eastern Oklahoma (near Muskogee, Muskogee County, *B. H. Slavin*); southwestern (Grand Tower, Jackson County, *H. A. Gleason*) and southern Illinois (Richland County, *R. Ridgway*).

Occasionally planted as a shade-tree in the streets of cities in northern Georgia and northern Alabama; hardy in eastern Massachusetts.

2. PLANERA Gmel.

A tree, with scaly puberulous branchlets roughened by scattered pale lenticels, and at the end of their first season by small nearly orbicular leaf-scars marked by a row of fibro-vascular bundle-scars, minute subglobose winter-buds covered by numerous thin

closely imbricated chestnut-brown scales, the outer more or less scarious on the margins, the inner accrescent, becoming at maturity ovate-oblong, scarious, bright red, $\frac{1}{3}'$–$\frac{1}{2}'$ long, marking in falling the base of the branchlet with pale ring-like scars. Leaves alternate, 2-ranked, ovate-oblong, acute or rounded at the narrowed apex, unequally cuneate or rounded at base, coarsely crenately serrate with unequal gland-tipped teeth, with numerous straight conspicuous veins forked near the margin and connected by cross reticulate veinlets more conspicuous below than above, when they unfold puberulous on the lower and pilose on the upper surface, at maturity thick or subcoriaceous and scabrate; petiolate with slender terete puberulous petioles; stipules lateral, free, ovate, scarious, bright red. Flowers polygamo-monœcious, the staminate fascicled in the axils of the outer scales of leaf-bearing buds, short-pedicellate, the pistillate or perfect on elongated puberulous pedicels in the axils of the leaves of the year in 1–3-flowered fascicles; pedicels without bracts; calyx campanulate, divided nearly to the base into 4 or 5 lobes rounded at apex, greenish yellow often tinged with red; stamens inserted under the ovary in the pistillate flower, sometimes few or 0; filaments filiform, erect, exserted; anthers broadly ovate, emarginate, cordate; ovary ovoid, stipitate, glandular-tuberculate, narrowed into a short style divided into 2 elongated reflexed stigmas papillo-stigmatic on the inner face, 0 in the staminate flower; ovule anatropous; micropyle extrorse, superior. Fruit an oblong oblique drupe, narrowed below into a short stipe, inclosed at the base by the withered calyx, crowned by the remnants of the style, its pericarp crustaceous, prominently ribbed on the anterior and posterior faces, irregularly tuberculate with elongated projections, and light chestnut-brown; seed ovoid, oblique, pointed at apex, rounded below, without albumen; testa thin, lustrous, dark brown or nearly black, of two coats; raphe inconspicuous; embryo erect; cotyledons thick, unequal, bright orange color, the apex of the larger hooded and slightly infolding the smaller, much longer than the minute radicle turned toward the linear pale hilum.

The genus is represented by a single species.

The generic name is in memory of Johann Jacob Planer, a German botanist and physician of the eighteenth century.

1. Planera aquatica Gmel. Water Elm.

Leaves $2'$–$2\frac{1}{2}'$ long, $\frac{3}{4}'$–$1'$ wide, on petioles varying from $\frac{1}{8}'$–$\frac{1}{4}'$ in length, dark dull green on the upper surface, paler on the lower surface, with a yellow midrib and veins. **Flowers** appearing with the leaves. **Fruit** ripening in April, $\frac{1}{3}'$ long.

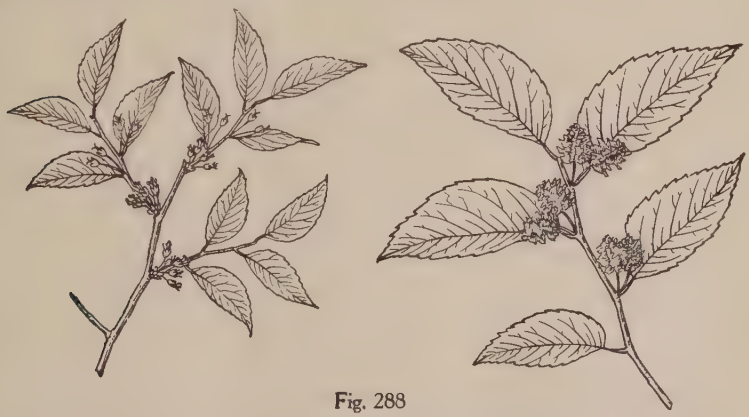

Fig. 288

A tree, 30°–40° high, with a short trunk rarely exceeding 20′ in diameter, rather slender spreading branches forming a low broad head, and branchlets brown tinged with red when

they first appear, dark red in their first winter, and ultimately reddish brown or ashy gray. **Bark** about $\frac{1}{4}'$ thick, light brown or gray, separating into large scales disclosing in falling the red-brown inner bark. **Wood** light, soft, not strong, close-grained, light brown, with thick nearly white sapwood of 20–30 layers of annual growth.

Distribution. Swamps covered with water during several months of the year, or low river banks; valley of the Cape Fear River, North Carolina, southward to northern Florida (Bradford County) and westward usually not far from the coast through the Gulf states to the valleys of the Navasota (Brazos County) and of the Colorado (Matagorda County) Rivers, Texas, and northward through western Louisiana, eastern Oklahoma, and Arkansas to southeastern Missouri, northeastern Mississippi (near Iuka, Tishomingo County, *T. G. Harbison*), northern Kentucky (Henderson County), and the valley of the lower Wabash River, Illinois; comparatively rare and confined to the coast plain in the Atlantic states; abundant and of its largest size in western Louisiana and southern Arkansas.

3. CELTIS L.

Trees or shrubs, with thin, smooth often more or less muricate bark, unarmed or spinose branchlets, and scaly buds. Leaves serrate or entire, 3-nerved in one species, membranaceous or subcoriaceous, deciduous; stipules lateral, free, usually scarious, inclosing their leaf in the bud, caducous. Flowers polygamo-monœcious or rarely monœcious, appearing soon after the unfolding of the leaves, minute, pedicellate, on branches of the year, the staminate cymose or fascicled at their base, the pistillate solitary or in few-flowered fascicles from the axils of upper leaves; calyx divided nearly to the base into 4 or 5 lobes, greenish yellow, deciduous; stamens inserted on the margin of the discoid torus; filaments subulate, incurved in the bud, those of the sterile flower straightening themselves abruptly and becoming erect and exserted, shorter and remaining incurved in the perfect flower; anthers ovoid, attached on the back just above the emarginate base; ovary ovoid, sessile, green and lustrous, crowned with a short sessile style divided into diverging elongated, reflexed acuminate entire lobes papillo-stigmatic on the inner face and mature before the anthers of the sterile flower, deciduous; minute and rudimentary in the staminate flower; ovule anatropous. Fruit an ovoid or globose drupe tipped with the remnants of the style, with thin flesh covered by a thick firm skin, and a thick-walled bony nutlet, reticulate-pitted in the American species. Seed filling the seminal cavity; albumen scanty, gelatinous, nearly inclosed between the folds of the cotyledons, or 0; testa membranaceous, of 2 confluent coats; chalaza colored, close to the minute hilum; embryo curved; cotyledons broad, foliaceous, conduplicate or rarely flat, variously folded, corrugate, incumbent, or inclosing the short superior ascending radicle.

Celtis is widely distributed through the temperate and tropical regions of the world, fifty or sixty species being distinguished.

Trees of the American species are often disfigured by gall-making insects which distort the buds and cause the production of dark broom-like clusters of short slender branchlets at the end of the branches.

Celtis was the classical name of a species of Lotus.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Fruit on pedicels much longer than the petioles.

Leaves not covered below with conspicuous reticulate veinlets, green on both surfaces, smooth or rough above; fruit dark purple. **1. C. occidentalis.**

Leaves covered below with a network of prominent veinlets, usually rough above.

Leaves pale on the lower surface.

Leaves broadly ovate, obliquely rounded at base, coarsely serrate, glabrous or slightly pilose below along the midrib and veins; fruit light orange-brown, the pedicels often 3 or 4 times longer than the petioles. **2. C. Douglasii.**

Leaves oblong-ovate, mostly cordate or occasionally rounded at base, entire or slightly serrate toward the apex, covered below with pilose pubescence; fruit dark reddish brown, the pedicels usually not more than twice as long as the petioles. 3. **C. Lindheimeri.**

Leaves green on the lower surface, broadly ovate, obliquely rounded at base, entire, pubescent along the midrib and veins below, rarely smooth on the upper surface; fruit dark orange-red, the pedicels usually not more than twice as long as the petioles. 4. **C. reticulata.**

Fruit on pedicels shorter or only slightly longer than the petioles.

Leaves oblong-lanceolate, long-acuminate, unsymmetrically cuneate at base, often falcate, entire or more or less serrate, smooth or rarely roughened on the upper surface; fruit orange color or yellow, the pedicels shorter or somewhat longer than the petioles. 5. **C. laevigata.**

Leaves ovate-lanceolate, acute or acuminate, obliquely rounded at base, coarsely serrate or nearly entire, smooth or in var. *georgiana* roughened on the upper surface; fruit dark orange red, the pedicels usually shorter than the petioles. 6. **C. pumila.**

1. Celtis occidentalis L. Hackberry. Sugarberry.

Leaves ovate, short-acuminate or acute at apex, obliquely rounded at base, sharply serrate often only above the middle, thin, slightly pubescent below on the slender midrib and veins early in the season, becoming glabrous or nearly glabrous, $2\frac{1}{2}'$–$3\frac{1}{2}'$ long, $1\frac{1}{2}'$–$2'$

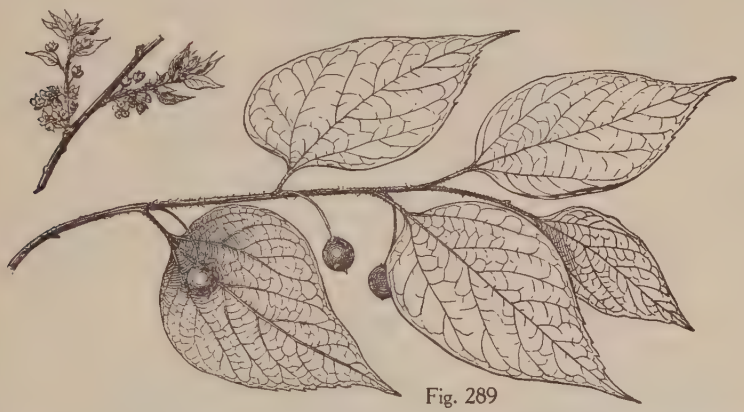

Fig. 289

wide; turning yellow late in the autumn; petioles slender, glabrous, $\frac{1}{3}'$–$\frac{1}{2}'$ in length. **Flowers** on drooping pedicels; calyx divided usually into 5 linear acute thin and scarious lobes rounded on the back, more or less laciniately cut, and often furnished with a tuft of pale hairs at apex; torus hoary-tomentose. **Fruit** on stems $\frac{1}{2}'$–$\frac{3}{4}'$ long, ripening in September and October and often remaining on the branches during the winter, subglobose, ovoid or obovoid, dark purple, $\frac{1}{3}'$ in diameter, with a thick tough skin, dark orange-colored flesh and a thick-walled oblong pointed light brown slightly rugose nutlet; seed pale brown.

A tree, rarely more than 40°–50° high with a trunk usually not more than 2° in diameter, spreading often pendulous branches forming a round-topped head, and slender ridged light brown glabrous branchlets marked by oblong pale lenticels, and by horizontal semioval or oblong leaf-scars showing the ends of three fibre-vascular bundles, becoming darker and in their second or third year often dark red-brown. **Winter-buds** ovoid, pointed, flattened, about $\frac{1}{4}'$ long, with three pairs of chestnut-brown ovate acute pubescent caducous scales closely imbricated in two ranks, increasing in size from without inward. **Bark** $1'$–$1\frac{1}{2}'$

thick, smooth, dark brown, and more or less thickly covered and roughened by irregular wart-like excrescences or by long ridges also found on the large branches. Wood heavy, rather soft, not strong, coarse-grained, clear light yellow, with thick lighter-colored sapwood; used for fencing and in the manufacture of cheap furniture.

Distribution. Rocky hills and ridges; New England (rare) to Virginia and westward to Iowa, eastern North Dakota, southwestern Missouri and northwestern Kansas.

Often planted in some of its forms as a shade and ornamental tree in the towns of the Mississippi valley and occasionally in the eastern states and in Europe.

Well distinguished by its large dark fruit, *Celtis occidentalis* is so variable in the shape of its leaves that two principal varieties are described as follows:

Celtis occidentalis var. canina Sarg. Hackberry.

Celtis canina Raf.

Leaves oblong-ovate, gradually narrowed into a long acuminate point, obliquely rounded or unsymmetrically cuneate at base, finely serrate, glabrous or rarely pilose along the midrib and veins below, $2\frac{1}{2}'$–$6'$ long and $\frac{3}{4}'$–$2\frac{1}{2}'$ wide; petioles slender, glabrous or rarely pubescent, $\frac{1}{2}'$–$\frac{3}{4}'$ long.

Fig. 290

A tree, often 80°–100° high; more common than the other forms of *Celtis occidentalis*.

Distribution. Rich wooded slopes and bottoms, or eastward on rocky ridges; Province of Quebec to eastern Nebraska, and southward to the coast of Massachusetts, western New York, southern Ohio, southern Indiana and Illinois, southwestern Missouri, southwestern Oklahoma (Snyder, Kiowa County), and in northwestern Georgia.

Celtis occidentalis var. crassifolia A. Gray. Hackberry.

Celtis crassifolia Lam.

Leaves thicker, long-acuminate, obliquely rounded at base, usually more coarsely serrate, rarely nearly entire, rough on the upper surface, pilose below along the prominent midrib and veins, $3\frac{1}{2}'$–$5'$ long, $2'$–$2\frac{1}{2}'$ wide, much smaller in the Rocky Mountain region; petioles villose-pubescent, rarely glabrous, $\frac{1}{4}'$–$\frac{1}{2}'$ in length, much shorter than the pubescent pedicels of the fruit.

A tree, 100°–120° high; with pubescent or glabrous branchlets; rarely shrubby. The most widely distributed form of *Celtis occidentalis*.

Distribution. Wooded slopes and rich bottoms; Virginia and along the Appalachian Mountains to North Carolina and westward to southern Minnesota, Missouri, central

Kansas, eastern and northwestern Oklahoma, central Nebraska, North and South Dakota, cañons of the Big Horn Mountains, Wyoming, and northwestern Idaho, and southward to Dallas County, Alabama, and eastern Texas.

Fig. 291

Often cultivated in towns of the Mississippi Valley and in western Europe, and occasionally in the eastern states.

2. Celtis Douglasii Plan. Hackberry.

Celtis rugulosa Rydb.

Leaves broadly ovate to oblong-ovate, acuminate, obliquely rounded or unsymmetrically subcordate at base, coarsely serrate, rough on the upper surface, pale and covered below

Fig. 292

with a network of reticulate veinlets inconspicuous early in the season, later becoming prominent, glabrous or sparingly pilose along the under side of the stout midrib and pri-

mary veins, 2′–2½′ long, 1′–2′ wide; petioles stout, slightly pubescent, ¼′–½′ in length. **Flowers** on slender pubescent pedicels; calyx divided into five linear acute scarious lobes laciniately cut at apex; torus hoary-tomentose. **Fruit** on slender drooping slightly pubescent or glabrous pedicels, ⅓′–½′ in length, subglobose to ellipsoid, light orange-brown, lustrous, ⅓′ in diameter.

A small tree or shrub rarely more than 20′ high, with slender slightly pubescent or glabrous red-brown branchlets marked by small pale lenticels, becoming ashy gray in their second or third year. **Bark** rough, red-brown or gray.

Distribution. Dry hillsides and rocky river banks; eastern Oregon from the valley of the Deschutes and Columbia Rivers to the cañon of Snake River, Whitman County, Washington, and to Big Willow Creek, Cañon County, western Idaho; on the western foothills of the Wasatch Mountains, in the cañon of Grand River, and in Diamond Valley, Utah; southern California, near Independence, Inyo County, Hackberry Cañon, Kern County, and Things Valley at base of Laguna Mountain, near Campo, southern San Diego County; on Cedros Island, and in northern Lower California; rim of the Grand Cañon, Arizona, and on the eastern foothills of the Rocky Mountains of Colorado.

Occasionally planted in the towns of western Washington, and when cultivated said to grow in good soil into a larger and more shapely tree with thinner leaves.

3. Celtis Lindheimeri K. Koch. Palo Blanco.

Celtis Helleri Small.

Leaves oblong-ovate, acuminate or acute, cordate or obliquely cordate or rounded at base, entire, or crenately serrate on vigorous shoots, rough above, pale and clothed below with white hairs, becoming by midsummer thick and covered below with a conspicuous network of reticulate veinlets, 1½′–3′ long, ¾′–2′ wide; petioles densely villose-pubescent,

Fig. 293

¼′–½′ in length. **Flowers** opening toward the end of March on pubescent pedicels; calyx divided into five oblong scarious lobes narrowed and rounded at apex; torus tomentose. **Fruit** on slender tomentose stems ¼′–⅔′ long, ripening in September and persistent on the branches until spring, subglobose to ellipsoid, dark reddish brown, lustrous, ¼′ in diameter.

A tree, occasionally 30° high, with a trunk rarely more than 12′–18′ in diameter, stout spreading branches forming a broad open irregular head, and slender pubescent branchlets roughened by numerous small lenticels, becoming darker and glabrous in their second season. **Bark** of the trunk and large branches dark and covered with high thick wart-like excrescences and ridges. **Wood** not strong nor durable, of little value even for fuel.

Distribution. Rich bottom-lands and on low adjacent hills of streams flowing southward from the Edward's Plateau (Goliad, San Antonio, New Braunfels, San Marcos) and near Austin, Travis County, Texas.

4. Celtis reticulata Torr. Hackberry.

Leaves broadly ovate, acute or acuminate, obliquely rounded at base, entire, thick, dark green and rough or rarely smooth on the upper surface, yellow-green and conspicuously reticulate-venulose and sparingly pilose along the prominent midrib and veins on

Fig. 294

the lower surface, $1\frac{1}{4}'$–$3'$ long, $\frac{3}{4}'$–$1\frac{1}{2}'$ wide; petioles stout, $\frac{1}{8}'$–$\frac{1}{4}'$ in length, more or less densely pubescent. **Flowers** not seen. **Fruit** on pubescent pedicels $\frac{1}{3}'$–$\frac{1}{2}'$ in length, ripening in September, subglobose to ellipsoid, orange-red or yellow, lustrous, $\frac{1}{4}'$ in diameter.

A tree, rarely 30° high with stout ascending branches forming an open irregular head, and slender red-brown branchlets tomentose or pubescent early in their first season and pubescent or glabrous in their second year; or often a shrub. **Bark** thick and rough.

Distribution. Dry limestone hillsides, rocky ridges and cañon slopes, western Texas, from the valley of the upper Rio Frio, Uvalde County, to Oklahoma (Ozark region, near Page, Le Flore County to the southwestern borders of the state); in mountain ravines through southern New Mexico, and in southern central and northeastern Arizona.

A variety with more pubescent serrate leaves, those on vigorous shoots mostly cordate at base and covered above with short white hairs, is distinguished as var. *vestita* Sarg. A small tree with slender pubescent branchlets and a trunk 12′–15′ in diameter. In low ground, along the North Fork of the Canadian River, near Canton, Blaine County, Oklahoma.

5. Celtis laevigata Willd. Sugarberry. Hackberry.

Celtis mississippiensis Spach.

Leaves oblong-lanceolate, long-pointed and acuminate at apex, unsymmetrically rounded or cuneate or obliquely cuneate at base, often falcate, entire or furnished with a few teeth near the apex or serrate (var. *Smallii* Sarg.), thin, smooth, glabrous or rarely rough above, light green on both surfaces, $2\frac{1}{2}'$–$5'$ long and $\frac{3}{4}'$–$1\frac{1}{2}'$ wide, with a narrow yellow

midrib, slender veins arcuate and united near the margins, and inconspicuous reticulate veinlets; petioles slender, glabrous, $\frac{1}{4}'$–$\frac{1}{2}'$ in length. **Flowers** on slender glabrous pedicels; calyx divided into five ovate-lanceolate glabrous or puberulous scarious lobes furnished at apex with tufts of long white hairs. **Fruit** on glabrous pedicels shorter or slightly longer than the petioles, ripening in September, short-oblong to ellipsoid or obovoid, orange-red or yellow, $\frac{1}{4}'$ in diameter; nutlet slightly rugose.

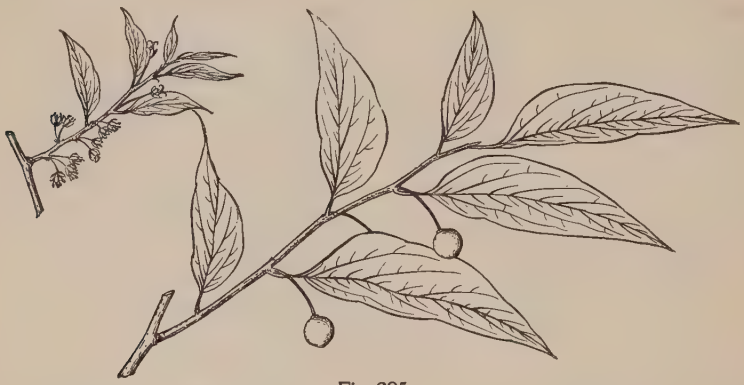

Fig. 295

A tree, 60°–80° high, with a trunk 2°–3° in diameter, spreading or pendulous branches forming a broad head, and slender branchlets light green, glabrous or pubescent when they first appear, and during their first winter bright reddish brown, rather lustrous and marked by oblong pale lenticels and narrow elevated horizontal leaf-scars showing the ends of three fibro-vascular bundles; often much smaller. **Winter-buds** ovoid, pointed, $\frac{1}{16}'$–$\frac{1}{8}'$ long, with chestnut-brown puberulous scales. **Bark** $\frac{1}{2}'$–$\frac{2}{3}'$ thick, pale gray and covered with prominent excrescences. **Wood** soft, not strong, close-grained, light yellow, with thick lighter-colored sapwood; commercially confounded with the wood of *Celtis occidentalis* and its varieties, and used for the same purposes.

Distribution. Coast of Virginia to the Everglades Keys of southern Florida, through the Gulf states to the valley of the lower Rio Grande in Nuevo Leon, and through eastern Texas, Arkansas and Missouri to eastern Oklahoma to the valley of the Washita River (Zarvin County) and to Kiowa County, eastern Kansas, central Tennessee and Kentucky, and to southern Illinois and Indiana; in Bermuda.

Often planted as a shade and street tree in the valley of the Mississippi River and in Texas.

An arborescent form from the rocky banks of the Nueces River, western Texas, with shorter and thicker leaves is distinguished as var. *brachyphylla* Sarg.; and a small shrubby form with oblong-ovate cordate leaves and dark purplish fruit covered with a glaucous bloom, growing in deep sand in Callihan County, Texas, has been described as var. *anomala* Sarg. An Arizona form is

Celtis laevigata var. brevipes Sarg.

Celtis brevipes S. Wats.

Leaves ovate, acuminate, unsymmetrically rounded or cuneate at base, entire or rarely furnished with occasional teeth, glabrous, dark green and smooth on the upper surface, yellow-green on the lower surface, with small clusters of pale hairs in the axils of the slender veins, and inconspicuous reticulate veinlets, $1\frac{1}{2}'$–$2'$ long, $\frac{3}{4}'$–$1'$ wide; petioles slender,

puberulous, $\frac{1}{4}'$–$\frac{1}{3}'$ in length. **Fruit** on glabrous pedicels shorter or slightly longer than the petioles, short-oblong, canary yellow, about $\frac{1}{4}'$ long.

Fig. 296

A small tree with slender glabrous red-brown branchlets.

Distribution. Central and southern Arizona.

More distinct is the common Celtis of western Texas which has been described as

Celtis laevigata var. texana Sarg.

Leaves ovate to lanceolate, acuminate, unsymmetrically rounded or cordate at base, entire or sparingly and irregularly serrate, often subcoriaceous, dark green, smooth and granulate or rarely rough above, green below, with a slender midrib and primary veins glabrous or sparingly villose-pubescent and furnished with small tufts of axillary hairs, and only slightly raised reticulate veinlets, $1\frac{1}{2}'$–$3'$ long and $\frac{3}{4}'$–$1\frac{1}{2}'$ wide; petioles slender,

Fig. 297

pale pubescent, $\frac{1}{5}'$–$\frac{1}{4}'$ in length. **Fruit** on glabrous or puberulous pedicels slightly longer than the petioles, subglobose but rather longer than broad, dark orange-red, about $\frac{1}{4}'$ long.

An arborescent shrub or small tree rarely more than 25° high, with slender reddish glabrous or gray-brown pubescent branchlets; often growing in clusters. **Bark** rough, pale or grayish and not often covered with wart-like excrescences.

Distribution. Rocky bluffs near Dallas to New Braunfels, Texas, and westward to

western Oklahoma, and southern New Mexico; in southwestern Missouri; in Tamaulipas and Coahuila, Mexico. The common Celtis of the Texas Panhandle.

A shrubby form from Nolan County, Texas, with red-brown branchlets densely pubescent in their first season, becoming puberulous during their second year, and smaller leaves with more prominent reticulate veinlets, on densely pubescent petioles, is distinguished as forma *microphylla* Sarg.

6. Celtis pumila Pursh.

This shrub of the eastern states is sometimes a small tree in its southern variety,

Celtis pumila var. georgiana Sarg.

Leaves ovate, acute or acuminate, obliquely rounded at base, entire or sharply serrate, especially on vigorous leading shoots, thin, dark green and rough on the upper surface, pale and more or less pubescent or nearly glabrous along the midrib and veins below, $1\frac{1}{2}'$–$2\frac{1}{2}'$ long and $\frac{3}{4}'$–$1\frac{1}{2}'$ wide; petioles slender, pubescent, $\frac{1}{6}'$–$\frac{1}{4}'$ in length. **Flowers** on pubescent pedicels; calyx divided into usually five lanceolate acuminate lobes; the disk

Fig. 298

pubescent. **Fruit** on pubescent pedicels as long or slightly longer than the petioles, subglobose, reddish purple, often covered with a glaucous bloom, $\frac{1}{2}'$ in diameter; nutlet covered with conspicuous reticulate ridges.

A shrub or small tree occasionally 30° high, with slender dark red-brown pubescent branchlets, light red-brown and sometimes bright red-brown before the end of their first year.

Distribution. Piedmont region of North and South Carolina, central Georgia to western Florida; and Dallas County, Alabama; in southern Missouri, and southern Illinois.

4. TREMA Lour.

Unarmed trees and shrubs with watery juices and terete branchlets. Leaves alternate, often two-ranked, serrate, penniveined, three-nerved from the base, short-petiolate, persistent; stipules lateral, free, usually small, caducous. Flowers apetalous, small, monœcious, diœcious or rarely perfect, in axillary cymes; calyx five or rarely four-parted, the lobes induplicate, valvate or slightly imbricated in the bud, or in perfect flowers more or less concave and induplicate; stamens five or rarely four, opposite the calyx-lobes and inserted on their base, occasionally present in the pistillate flower; filaments short, erect; anthers oblong, attached on the back near the base, introrse, two-celled, the cells opening

longitudinally; ovary sessile, rudimentary or wanting in the staminate flower; style central, slightly or entirely divided into two linear fleshy stigmatic branches; ovule solitary, pendulous from the apex of the cell, anatropous; micropyle superior. Fruit drupaceous, short-oblong to subglobose, crowned by the persistent style; exocarp more or less fleshy; endocarp hard; seed filling the cavity of the nutlet; testa membranaceous, albumen fleshy, often scanty; embryo curved or slightly involute; cotyledons narrow; radicle incurved, ascending.

Trema, with about twenty species, is widely distributed in tropical and subtropical regions of the two hemispheres. Two species reach the coast region and the keys of southern Florida. Of these *Trema mollis* Lour. is a small tree, and *Trema Lamarckiana* Bl., which in Florida has been noticed only on Key Largo, where it grows as a small shrub, is widely distributed over the Bahamas and many of the West Indian islands.

1. Trema mollis Lour.

Trema floridana Britt.

Leaves 2-ranked, ovate, abruptly acuminate at apex, rounded, cordate and often oblique at base, finely serrate with incurved or rounded apiculate teeth, dark green and scabrate above, covered with pale tomentum below, 3′–4′ long, 1′–2½′ wide; petioles stout, tomentose, about ⅖′ in length; stipules narrow, acuminate, covered with long white hairs, about one third as long as the petioles. **Flowers** in early spring, subtended by minute scarious deciduous bracts on short slender pedicels in bisexual many-flowered pedunculate villose cymes about as long as the petioles; calyx 5-lobed, the lobes oblong, acute and incurved at apex, villose on the outer surface; staminate with glabrous filaments and slightly exserted yellow anthers; pistillate with a style divided to the base. **Fruit** short-oblong, pale yellowish brown, ⅛′–⅕′ in diameter.

Fig. 299

A fast-growing short-lived tree, in Florida occasionally 25°–30° high, with a tall trunk 1½′–2½′ in diameter, small crowded branches ascending at narrow angles, and stout hoary-tomentose red-brown 2-ranked branchlets. **Bark** thin, chocolate-brown, roughened by numerous small wart-like excrescences, and separating into small appressed papery scales.

Distribution. Rich hummocks; near the shores of Bay Biscayne, in the Everglades, and

on the southern keys, Florida; common; noticed by R. M. Harper with many specimens in a large dense Palmetto grove a few miles north of Immokalee, Collier County; often springing up where the ground has been burned over, or otherwise cleared of its forests; on many of the West Indian islands and in Mexico.

XII. MORACEÆ.

Tree or shrubs, with milky juice, scaly or naked buds, and stalked alternate simple leaves with stipules. Flowers monœcious or dicœcious, in ament-like spikes, or in heads on the outside of a receptacle or on the inside of a closed receptacle; calyx of the staminate flower 2–6-lobed or parted; stamens 1–4, inserted on the base of the calyx; calyx of the pistillate flower of 2–6 partly united sepals; ovary 1–2-celled; styles 1 or 2; ovule pendulous. Fruits drupaceous, inclosed in the thickened calyx of the flower and united into a compound fruit (*syncarp*). The Mulberry family is widely distributed with fifty-four genera confined largely to the warmer parts of the world. Three genera only, all arborescent, are indigenous in North America, although *Broussonetia papyrifera* Vent., the Paper Mulberry, a tree related to the Mulberry and a native of eastern Asia, and the Hop and the Hemp are more or less generally naturalized in the eastern and southern states.

CONSPECTUS OF THE NORTH AMERICAN GENERA.

Flowers on the outside of the receptacle; buds scaly.
  Flowers in ament-like spikes; syncarp oblong and succulent. 1. **Morus.**
  Staminate flowers racemose, the pistillate capitate; syncarp dry and globose. 2. **Maclura.**
Flowers on the inside of a closed receptacle; buds naked; syncarp subglobose to ovoid, succulent. 3. **Ficus.**

1. MORUS L. Mulberry.

Trees or shrubs, with slender terete unarmed branches prolonged by one of the upper axillary buds, scaly bark, fibrous roots, and winter-buds covered by ovate scales closely imbricated in 2 ranks, increasing in size from without inward, the inner accrescent, marking in falling the base of the branch with ring-like scars. Leaves conduplicate in the bud, alternate, serrate, entire or 3-lobed, 3–5-nerved at base, membranaceous or subcoriaceous, deciduous; stipules inclosing their leaf in the bud, lateral, lanceolate, acute, caducous. Flowers monœcious or dicœcious, the staminate and pistillate on different branches of the same plant or on different plants, minute, vernal, in pedunculate clusters from the axils of caducous bud-scales or of the lower leaves of the year; staminate in elongated cylindric spikes; calyx deeply divided into 4 equal rounded lobes; stamens 4, inserted opposite the lobes of the calyx under the minute rudimentary ovary, filaments filiform, incurved in the bud, straightening elastically and becoming exserted, anthers attached on the back below the middle, introrse, 2-celled, the cells reniform, attached laterally to the orbicular connective, opening longitudinally; pistillate sessile, in short-oblong densely flowered spikes; calyx 4-parted, the lobes ovate or obovate, thickened, often unequal, the 2 outer broader than the others, persistent; ovary ovoid, flat, sessile, included in the calyx, crowned by a central style divided nearly to the base into 2 equal spreading filiform villose white stigmatic lobes; ovule suspended from the apex of the cell, campylotropous; micropyle superior. Drupes ovoid or obovoid, crowned with the remnants of the styles, inclosed in the succulent thickened and colored perianth of the flower and more or less united into a more or less juicy compound fruit; flesh subsucculent, thin; walls of the nutlet thin or thick, crustaceous. Seed oblong, pendulous; testa, thin, membranaceous; hilum minute, apical; embryo incurved in thick fleshy albumen; cotyledons oblong, equal; radicle ascending, incumbent.

Morus with eight or nine species is confined to eastern temperate North America, the elevated regions of Mexico, Central America and western South America, southern and

western Asia, Indo-China, China, Japan, the Bonin Islands and the mountains of the Indian Archipelago. Two species occur in North America. The most valuable species, *Morus alba* L., a native of China and Formosa, and largely cultivated in many countries for its leaves, which are the best food of the silkworm, has been planted in large quantities in the eastern United States; and *Morus nigra* L., probably a native of Persia, has been introduced into the southern and Pacific states for its large dark-colored juicy fruit. Morus produces straight-grained durable light brown or orange-colored valuable wood, and sweet acidulous and refreshing fruits.

Morus is the classical name of the Mulberry-tree.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Leaves coated below with pale pubescence; lobes of the stigma long; syncarp oblong, dark purple. **1. M. rubra** (A, C).

Leaves glabrous or pubescent below; lobes of the stigma short; syncarp subglobose or short-ovoid, nearly black. **2. M. microphylla** (C, E, H).

1. Morus rubra L. Red Mulberry.

Leaves ovate, oblong-ovate or semiorbicular, abruptly contracted into a long broad point or acute at apex, more or less deeply cordate or occasionally truncate at base, coarsely and occasionally doubly serrate with incurved callous-tipped teeth, often, especially on

Fig. 300

vigorous young shoots, 3-lobed by broad deep oblique lateral rounded sinuses, when they unfold yellow-green, slightly pilose on the upper surface and hoary-tomentose on the lower surface, at maturity thin, dark bluish green, glabrous, smooth or scabrate above, pale and more or less pubescent below with short white hairs thickest on the orange-colored midrib, and on the primary veins arcuate and united near the margins and connected by reticulate veinlets, or sometimes hoary-tomentose below (var. *tomentosa* Bureau), 3′–5′ long, $2\frac{1}{2}$′–4′ wide; turning bright yellow in the autumn; petioles stout, hoary-tomentose at first, becoming glabrous, $\frac{3}{4}$′–$1\frac{1}{4}$′ in length; stipules lanceolate, acute, abruptly enlarged and thickened at base, sometimes tinged with red above the middle, coated with long white hairs, and often 1′ in length. **Flowers** appearing with the unfolding of the leaves; staminate in narrow spikes 2′–$2\frac{1}{2}$′ long, on stout light green peduncles covered with pale hairs; calyx divided nearly to the base into oblong concave lobes rounded at apex and hirsute on the outer surface; stamens with slightly flattened filaments narrowed from the base to the apex, and bright green anthers, their connectives orbicular, conspicuous, bright green; pis-

tillate in oblong densely flowered spikes, 1′ long, on short hairy peduncles, a few male flowers being sometimes mixed with them; calyx divided nearly to the base into 4 thick concave lobes rounded at apex, rounded or slightly keeled on the back, the 2 outer lobes twice as wide as the others, as long as and closely investing the glabrous light green ovary. **Fruit:** syncarp at first bright red when fully grown, 1′–1¼′ long, becoming dark purple or nearly black and sweet and juicy when fully ripe; drupes about ½′ long, with a thin fleshy outer coat and a light brown nutlet; seed ovoid, acute, with a thin membranaceous light brown coat.

A tree, 60°–70° high, with a short trunk rarely exceeding 3°–4° in diameter, stout spreading smooth branches forming a dense broad round-topped shapely head, and slender slightly zigzag branchlets dark green often tinged with red, glabrous, more or less coated with pale pubescence, and covered with oblong straw-colored spots when they first appear, becoming in their first winter light red-brown to orange color and marked by pale lenticels and by large elevated horizontal nearly orbicular concave leaf-scars displaying a row of prominent fibro-vascular bundle-scars, and in their second and third years dark brown slightly tinged with red. **Winter-buds** ovoid, rounded or pointed at apex, ¼′ long, with 6 or 7 chestnut-brown scales, those of the outer rows broadly ovate, rounded, and slightly thickened on the back, puberulous, ciliate on the margins, and much shorter than those of the next rows, the inner scales scarious, coated with pale hairs, oblong-lanceolate, rounded or acute at apex, and ½′–⅔′ long at maturity. **Bark** ½′–¾′ thick, dark brown tinged with red and divided into irregular elongated plates separating on the surface into thick appressed scales. **Wood** light, soft, not strong, rather tough, coarse-grained, very durable, light orange color, with thick lighter colored sapwood; largely used for fencing, in cooperage, and in boatbuilding.

Distribution. Intervales in rich soil and on low hills; western Massachusetts, Connecticut, and Long Island to southern Ontario, central Michigan, southeastern Minnesota, eastern Iowa, southeastern South Dakota, eastern Nebraska, central Kansas and Oklahoma, and southward to the shores of Bay Biscayne and Cape Romano, Florida, and to the cañon of the Devil's River, Valverde County, Texas; most abundant and of its largest size in the basin of the lower Ohio River and on the foothills of the southern Appalachian Mountains; ascending to altitudes of 2000°.

Occasionally planted, especially in the southern states, for its fruit valued for fattening hogs and as food for poultry. A few natural varieties, distinguished for the large size and good quality of their fruit, or for their productiveness, are occasionally propagated by pomologists.

2. Morus microphylla Buckl. Mulberry. Mexican Mulberry.

Morus celtidifolia Sarg. not H. B. K.

Leaves ovate, acute or acuminate, rounded or rarely truncate, or often on vigorous shoots cordate at the broad base, and 3-lobed with shallow lateral sinuses and broad coarsely serrate lobes, when they unfold coated below with pale tomentum, and puberulous above, at maturity thin and firm in texture, dark green and often roughened on the upper surface by minute pale tubercles, and paler, smooth or scabrate, and glabrous or coated with soft pubescence on the lower surface, and often hirsute with short stiff pale hairs on the broad orange-colored midrib, and on the primary veins connected by conspicuous reticulate veinlets, rarely more than 1½′ long and ¾′ wide; turning yellow in the autumn; petioles slender, hoary-tomentose, becoming pubescent, ⅓′ in length; stipules linear-lanceolate, acute, sometimes falcate, white and scarious, coated with soft pale tomentum, about ½′ long. **Flowers** usually diœcious, staminate short-pedicellate, in short many-flowered spikes, ½′–¾′ long; calyx dark green, covered on the outer surface with soft pale hairs, deeply divided into equal rounded lobes reddish toward the apex; stamens with bright yellow anthers, their connectives conspicuous, dark green; pistillate sessile in few-flowered spikes, rarely ⅓′ in length; calyx divided to the base into thick rounded lobes, the 2 outer

lobes much broader than the others, dark green, covered with pale scattered hairs; ovary green and glabrous, with short stigmatic lobes. **Fruit:** syncarp $\frac{1}{2}'$ long, red becoming dark purple or nearly black, sweet and palatable; drupe $\frac{1}{8}'$ long, ovoid, rounded at the ends, with a thin fleshy outer covering and a thick-walled light brown nutlet; seed ovoid, pointed, pale yellow.

A tree, sometimes 15°–20° high, with a trunk occasionally 12′–14′ in diameter, and slender branchlets covered when they first appear with soft white hairs, soon becoming gla-

Fig. 301

brous or nearly so, and in their first winter light orange-red and marked by small lenticels and small horizontal nearly orbicular elevated concave leaf-scars displaying a ring of fibro-vascular bundle-scars; often a shrub. **Winter-buds** ovoid, acute, sharp-pointed, and covered by thin lustrous chestnut-brown ovate rounded scales scarious on the margins, those of the inner rows ovate-oblong, rounded at apex, pale-pubescent on the outer surface, and nearly 1′ long when fully grown. **Bark** smooth, sometimes nearly $\frac{1}{2}'$ thick but usually thinner, light gray slightly tinged with red, deeply furrowed and broken on the surface into slightly appressed scales. **Wood** heavy, hard, close-grained, dark orange color or sometimes dark brown, with thick light-colored sapwood.

Distribution. Dry limestone hills, or westward only in elevated mountain cañons in the neighborhood of streams; valley of the Colorado River, Texas, southward into Mexico and through the mountain regions of western Texas and southern New Mexico to the Santa Rita Mountains and the cañons of the Colorado Plateau, Arizona.

2. MACLURA Nutt.

Toxylon (*Ioxylon*) Rafn.

A tree, with thick milky slightly acrid juice, thick deeply furrowed dark orange-colored bark, stout tough terete pale branchlets, with thick orange-colored pith, lengthening by an upper axillary bud, marked by pale orange-colored lenticels and armed with stout straight axillary spines, short stout spur-like lateral branchlets from buds at the base of the spines, and thick fleshy roots covered by bright orange-colored bark exfoliating freely in long thin persistent papery scales. Leaves involute in the bud, ovate to oblong-lanceolate, acuminate and apiculate at apex, rounded, cuneate or subcordate at base, entire, penniveined, the veins arcuate near the margins and connected by conspicuous reticulate veinlets; petioles elongated, slender, terete, pubescent; stipules lateral, nearly triangular, minute, hoary-tomentose, caducous. Flowers dicœcious, light green, minute, appearing in

early summer; calyx 4-lobed, the lobes imbricated in æstivation; the staminate long-pedicellate, in short or ultimately elongated racemes borne on long slender drooping peduncles from the axils of crowded leaves on the spur-like branchlets of the previous year; calyx ovoid, gradually narrowed into the slender pubescent pedicel, coated on the outer surface with pale hairs, divided to the middle into equal acute boat-shaped lobes; stamens 4, inserted opposite the lobes of the calyx on the margins of the minute thin pulvinate disk; filaments flattened, light green, glabrous, infolded above the middle in the bud, with the anthers inverted and back to back, straightening abruptly in anthesis and becoming exserted; anthers oblong, attached on the back near the middle, introrse, 2-celled, the cells attached laterally to a minute oblong or semiorbicular connective, free and spreading above and below, opening by longitudinal lateral slits; pistillate sessile in dense globose many-flowered heads on short stout peduncles axillary on shoots of the year; calyx ovoid, divided to the base into oblong thick concave lobes, rounded, thickened, and covered with pale hairs at the apex, longer than the ovary and closely investing it, the 2 outer lobes much broader than the others, persistent and inclosing the fruit; ovary ovoid, compressed, sessile, green, and glabrous; style covered by elongated slender filiform white stigmatic hairs; ovule suspended from the apex of the cell, anatropous. Drupes oblong, compressed, rounded and often notched at apex, acute at base, with thin succulent flesh, and a thin crustaceous light brown nutlet, joined by the union of the thickened and much elongated perianths of the flowers into a globose compound fruit saturated with milky juice, mammillate on the surface by their thickened rounded summits, light yellow-green, usually of full size but seedless on isolated pistillate individuals. Seed oblong, compressed, rounded at base, oblique and marked at apex by the conspicuous oblong pale hilum, without albumen; seed-coat membranaceous, light chestnut-brown; embryo recurved; cotyledons oblong, nearly equal; radicle elongated, incumbent, ascending.

The genus is represented by a single species of eastern North America.

The generic name is in compliment to William Maclure, distinguished geologist.

1. Maclura pomifera Schn. Osage Orange. Bow Wood.

Toxylon (*Ioxylon*) *pomiferum* Rafn.

Leaves 3′–5′ long, 2′–3′ wide; turning bright clear yellow before falling in the autumn; petioles 1½′–2′ in length. **Flowers:** racemes of the staminate flowers 1′–1½′ long; heads

Fig. 302

of the pistillate flowers, ¾′–1′ in diameter. **Fruit** 4′–5′ in diameter, ripening in the autumn, and soon falling to the ground.

A tree, sometimes 50°–60° high, with a short trunk 2°–3° in diameter, and stout erect ultimately spreading branches forming a handsome open irregular round-topped head, and branchlets light green often tinged with red and coated with soft pale pubescence when they first appear, soon becoming glabrous, light brown slightly tinged with orange color during their first winter, and ultimately paler. **Winter-buds** depressed-globose, partly immersed in the bark, covered by few closely imbricated ovate rounded light chestnut-brown ciliate conspicuous scales. **Bark** ⅔′–1′ thick, and deeply and irregularly divided into broad rounded ridges separating on the surface into thin appressed scales. **Wood** heavy, exceedingly hard, very strong, flexible, coarse-grained, very durable, bright orange color turning brown on exposure, with thin light yellow sapwood of 5–10 layers of annual growth; largely used for fence-posts, railway-ties, wheel-stock, and formerly by the Osage and other Indians west of the Mississippi River for bows and war-clubs. The bark of the roots contains moric and morintannic acid, and is used as a yellow dye. The bark of the trunk is sometimes used in tanning leather.

Distribution. Rich bottom-lands; southern Arkansas to southern Oklahoma and southward in Texas to about latitude 35° 36′; most abundant and of its largest size in the valley of the Red River in Oklahoma.

Largely planted in the prairie regions of the Mississippi basin as a hedge plant, and occasionally in the eastern states; hardy in New England; occasionally naturalized beyond the limits of its natural range.

3. FICUS L. Fig.

Trees, with milky juice, naked buds, stout branchlets, thick fleshy roots frequently produced from the branches and developing into supplementary stems. Leaves involute, entire and persistent in American species; stipules inclosing the leaf in a slender sharp-pointed bud-like cover, interpetiolar, embracing the leaf-bearing axis and inclosing the young leaves, deciduous. Flower-bearing receptacle subglobose to ovoid, sessile or stalked, solitary by abortion or in pairs in the axils of existing or fallen leaves, surrounded at base by 3 anterior bracts distinct or united into an involucral cup bearing on the interior at the apex numerous rows of minute triangular viscid bracts closing the orifice, those of the lower rows turned downward and infolding the upper flowers, those immediately above these horizontal and forming a more or less prominent umbilicus. Flowers sessile or pedicellate, the pedicels thickening and becoming succulent with the ripening of the fruit, unisexual, often separated by chaffy scales or hairs; calyx of the staminate flower usually divided into 2–6 sepals; stamen 1 ; filament short, erect; anther innate, ovoid, broad and subrotund, 2-celled, the cells opening longitudinally, 0 in the pistillate flower; sepals or lobes of the calyx of the pistillate flower usually narrower than those of the staminate flower; ovary sessile, erect or oblique, surmounted by the lateral elongated style crowned by a 2-lobed stigma; ovule suspended from the apex or lateral below the apex of the cell, anatropous. Fruit mostly immersed in the thickened succulent receptacle, obovoid or reniform; flesh thin, mucilaginous; nutlet with a flat crustaceous minutely tuberculate shell. Seed suspended; testa membranaceous; embryo incurved, in thin fleshy albumen, cotyledons equal or unequal, longer than the incumbent radicle.

Ficus, of which about six hundred species have been described, is largely distributed through the topics of both hemispheres, the largest number of species being found on the islands of the Indian Archipelago and the Pacific Ocean. A few species extend beyond the tropics into southern Florida, Mexico, Argentina, southern Japan and China, the countries bordering the Mediterranean, the Canary Islands, and southern Africa. Two species of the section *Urostigma* with monœcious flowers occur in tropical Florida. *Ficus Carica* L., probably a native of the Mediterranean basin, is cultivated in the southern states and in California for its large sweet succulent fruits, the figs of commerce.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Receptacles subglobose, sessile or short-stalked; leaves oblong, usually pointed at the ends. **1. F. aurea (D).**

Receptacles obovoid, long-stalked; leaves broadly ovate, cordate at base. **2. F. brevifolia (D).**

1. Ficus aurea Nutt. Wild Fig.

Leaves oblong, usually narrowed at the ends, acute or acuminate, with a short broad point at apex, cuneate or rarely broad and rounded at base, 2′–5′ long, 1½′–3′ wide, thick and coriaceous, dark yellow-green and lustrous above, paler and less lustrous below, with

Fig. 303

a broad light yellow midrib slightly grooved on the upper side, and numerous obscure primary veins arcuate and united near the margins and connected by fine closely reticulated veinlets, continuing to unfold during a large part of the year; usually falling during their second season; petioles stout, slightly grooved, ½′–1′ in length; stipules ovate-lanceolate, thick, firm, tinged with red, about 1′ long. **Flowers:** receptacles developing in succession as the branch lengthens, subglobose, sessile or short-stalked, solitary or in pairs, the orifice lateral closed and marked by a small point formed by the union of the minute bracts, becoming ⅓′ in diameter and yellow when fully grown, ultimately turning bright red; flowers reddish purple, separated by minute reddish chaff-like scales more or less laciniate at apex, sessile or long-pedicellate; calyx of the staminate flower divided to below the middle into 2 or 3 broad lobes rather shorter than the stout flattened filaments; lobes of the anther oblong, attached laterally to the broad connective; calyx of the pistillate flower divided to the middle into 4 or 5 narrow lobes, closely investing the ovate sessile ovary. **Fruit** ovoid, immersed in the thickened reddish purple walls of the receptacle; **seed** ovoid, rounded at the ends, with a thin light brown coat and a large lateral oblong pale hilum.

A broad round-topped epiphytal tree, 50°–60° high, germinating and growing at first on the branches and trunks of other trees and sending down to the ground stout aerial roots which gradually growing together form a trunk often 3°–4° in diameter, the growth of additional roots from the branches extending the tree over a large area, and terete pithy light orange-colored branchlets marked by pale lenticels, conspicuous stipular scars, large slightly elevated horizontal oval leaf-scars displaying a marginal ring of large pale fibro-vascular bundle-scars, and smaller elevated concave circular scars left by the

receptacles in falling. **Bark** smooth, ashy gray, light brown tinged with red, $\frac{1}{2}'$ thick, and broken on the surface into minute appressed scales disclosing in falling the nearly black inner bark. **Wood** exceedingly light, soft, weak, coarse-grained, perishable in contact with the ground, light brown, with thick lighter colored sapwood.

Distribution. Hummocks on the shores and islands of southern Florida; from the Indian River on the east coast and Tampa Bay on the west coast, to the southern keys; common and now rapidly spreading over the eastern and southern borders of the Everglades; attaining its largest size in the neighborhood of Bay Biscayne; on the Bahama Islands.

2. Ficus brevifolia Nutt. Fig. Wild Fig.

Ficus populnea Sarg., not Willd.

Leaves broadly ovate or rarely obovate, contracted into a short broad point or occasionally rounded at apex, rounded, truncate or cordate at base, $2\frac{1}{2}'$–$5'$ long, $1\frac{1}{2}'$–$5'$ wide, thin and firm, dark green and lustrous on the upper surface, paler on the lower, with a light yellow midrib, and slender remote primary veins arcuate and united near the margins and connected by finely reticulate veinlets; petioles slender, sometimes $1'$ in length; stipules ovate-lanceolate, $\frac{1}{2}'$ long, tinged with red. **Flowers:** receptacles obovoid, solitary or in pairs, yellow until fully grown, ultimately turning bright red and becoming $\frac{1}{4}'$–$\frac{1}{2}'$ long, on stout drooping stalks $\frac{1}{4}'$–$1'$ in length; flowers sessile or pedicellate, separated by minute chaff-like scales more or less laciniate at apex; calyx of the staminate flower divided nearly to the base into three or four broad acute lobes; calyx of the pistillate flower with narrow lobes shorter than the ovoid pointed ovary. **Fruit** ovoid; **seed** ovoid, with a membranaceous light brown coat and an oblong lateral pale hilum.

Fig. 304

An epiphytal tree, rarely 40°–50° high, with a trunk 12′–18′ in diameter, spreading branches occasionally developing aerial roots and forming an open irregular head, and terete branchlets light red and slightly puberulous when they first appear, becoming brown tinged with orange and later with red, and marked by minute pale lenticels, narrow stipular scars, large elevated horizontal oval or semiorbicular leaf-scars showing a marginal row of conspicuous fibro-vascular bundle-scars, and elevated concave receptacle scars. **Wood** light, soft, close-grained, light orange-brown or yellow, with thick hardly distinguishable sapwood.

Distribution. Usually on dry slightly elevated coral rocks; Florida from the shores of Bay Biscayne to the Everglades Keys, and on several of the southern keys to Key West; not common; on the Bahama Islands and in Cuba.

XIII. OLACACEÆ.

Trees or shrubs, with watery juices, their stems sometimes twining, and alternate usually entire persistent leaves, without stipules. Flowers perfect or polygamous, in axillary cymes or racemes, rarely solitary; calyx 4 to 6-lobed; petals 4–6, inserted on a hypogynous disk, free or united into a campanulate or tubular corolla; stamens 4–12, inserted on the tube of the corolla; filaments free, rarely united; anthers oblong, introrse, opening longitudinally; ovary superior or partly inferior, free or immersed in the disk, 1–4-celled; styles mostly united; stigmas entire or lobed; ovules 1–3 in each cell of the ovary. Fruit drupaceous, naked or nearly inclosed in the enlarged disk, 1-celled, 1-seeded; seed pendulous; embryo minute, erect, in copious fleshly albumen; radicle superior.

Olacaceæ with twenty-five genera and a large number of species is confined to the tropics, and is most abundant in those of the Old World.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT GENERA.

Corolla-lobes short; stamens as many as its lobes; drupe almost inclosed in the enlarged disk of the flower; branches unarmed. **1. Schoepfia.**

Corolla-lobes elongated; stamens twice as many as its lobes; drupe nearly naked; branchlets armed. **2. Ximenia.**

1. SCHOEPFIA Schreb.

Trees or shrubs with slender unarmed branchlets. Leaves entire, subcoriaceous, petiolate. Flowers small, perfect in axillary cymes, rarely solitary; calyx disciform, obscurely 4-toothed, or nearly entire, petals 4, 5 or rarely 6, united, their tips free, valvate; stamens opposite the petals, filaments free, anthers attached by the back; ovary partly immersed in the disk, 3-celled; style elongated, stigma 3-lobed; ovules 3 in each cell, pendulous from the free apex of the axile placentas. Fruit nearly inclosed in the enlarged disk of the flower, the stone crustaceous or chartaceous.

Schoepfia with twelve or fourteen species is distributed in the New World from southern Florida and Lower California to Brazil and Peru, and in the Old World from southern Japan and southern and western China to the East Indies and the eastern Himalayas.

The generic name is in compliment to Johann David Schoepf, German physician and botanist, and traveler in North America and the West Indies.

1. Schoepfia chrysophylloides Planch.

Schoepfia Schreberi Small, not Gmel.

Leaves elliptic to oblong-ovate, often slightly falcate, acuminate at apex, cuneate and often unsymmetric at base, light green and lustrous above, paler below, $1\frac{1}{2}'$–$3'$ long, $\frac{3}{4}'$–

Fig. 305

$1\frac{1}{4}'$ wide, and on vigorous shoots sometimes 4′ long and $1\frac{3}{4}'$ wide; petioles stout, wing-margined, $\frac{1}{4}'$–$\frac{1}{3}'$ in length. **Flowers** sessile, pink or red, in axillary 1–3- usually 2-flowered clusters on peduncles $\frac{1}{24}'$–$\frac{1}{6}'$ in length; calyx cup-shaped, the rim slightly dilated, almost filled by the fleshy disk; corolla ovate-cylindric, $\frac{1}{8}'$–$\frac{1}{6}'$ long, 4-lobed, the lobes ovate, acute, united, reflexed; stamens 4, adnate to the base of the lobes of the corolla; anthers sessile; ovary mostly immersed in the disk; style not more than $\frac{1}{24}'$ long; **Fruit** ovoid or ovoid-oval scarlet, $\frac{3}{5}'$–$\frac{1}{2}'$ in length; stone crustaceous; **seed** not seen.

A tree, sometimes 25°–30° high with a trunk 12′–18′ in diameter, small erect branches and slender pale gray unarmed branchlets. **Bark** thin, grayish brown, closely and regularly reticulated.

Distribution. In sandy or rocky soil; banks of the Caloosahatchee River, Lee County, near Miami and at Cocoanut Grove, Dade County, and on the southern keys, Florida; on the Bahama Islands, and in Cuba, Jamaica, and Guatamala.

2. XIMENIA L.

Trees and shrubs, with terete armed or unarmed branchlets. Leaves entire, subcoriaceous, often fascicled, short-petiolate. Flowers perfect, white, on slender pedicels, in short axillary cymes or rarely solitary; calyx small, 4-lobed, the lobes imbricated in the bud, persistent; petals 4 or 5, hypogynous, narrow, bearded on their inner face, valvate in the bud, reflexed above the middle; stamens twice as many as the petals; filaments free, filiform; anthers linear, attached on the back near the base, 2-celled, the cells opening laterally, their connective apiculate at apex; ovary 4-celled below, only the apex 1-celled, externally 4-grooved, glandular at base, gradually narrowed into the slender style; stigma entire, subcapitate; ovules linear, solitary in each cell, pendulous from the apex of the axile placenta, anatropous; raphe dorsal; micropyle superior. Fruit ovoid or globose; exocarp thick and succulent, endocarp crustaceous or subligneous; seed filling the cavity of the endocarp, pendulous, surrounded by a thin spongy coat; testa membranaceous; cotyledons elliptic; embryo minute, erect; raphe terete.

Ximenia with four or five species is widely distributed on tropical shores of the two worlds.

Ximenia commemorates the name of Francisco Ximenes, a Dominican priest who published in Mexico in 1615 a work on the plants and animals of that country.

1. Ximenia americana L.

Leaves oblong or elliptic, rounded and often emarginate and apiculate at apex, gradually narrowed and cuneate at base, glabrous, bright green and lustrous above, pale below,

Fig. 306

$1\frac{1}{4}'$–$2\frac{1}{2}'$ long, $\frac{2}{5}'$–$1\frac{1}{4}'$ wide, with slightly thickened revolute margins, a prominent midrib and obscure primary veins; petioles slender, narrow wing-margined at apex, $\frac{1}{5}'$–$\frac{2}{5}'$ in length. **Flowers** bell-shaped, fragrant, about $\frac{1}{4}'$ long, on slender pedicels in the axils of minute acuminate caducous bractlets, in 3 or 4-flowered clusters on peduncles $\frac{1}{5}'$–$\frac{1}{3}'$ long; calyx-lobes acute, petals elliptic and rounded or obtusely pointed at apex, yellowish white, leathery, conspicuously bearded on the inner surface from base nearly to apex. **Fruit** broad-ovoid to subglobose, bright yellow, with thin acid flesh, $1'$–$1\frac{1}{4}'$ long, on slender pedicels about $\frac{1}{3}'$ in length, in usually 2 or 3-fruited drooping clusters; stone ovoid, apiculate at apex, covered with minute pits, light red; **seed** yellow, with bright orange-colored cotyledons.

A tree, occasionally 30° high, with a tall trunk $2\frac{1}{2}'$–$3\frac{1}{2}'$ in diameter, spreading branches armed with stout straight spines usually $\frac{3}{4}'$–$1'$ in length, and slender branchlets slightly angled and light reddish brown when they first appear, becoming terete and light gray or red-brown and marked by numerous lenticels; more often a shrub with long vine-like stems. **Bark** close, dark red, astringent. **Wood** very heavy, tough, hard, close-grained, compact, brown tinged with red with lighter-colored sapwood. Hydrocyanic acid has been obtained from the fruit.

Distribution. Florida, near Eustis Lake, Lake County, to the southern keys, attaining its largest size on the west coast and on Long Key in the Everglades; common on the shores of the Antilles and southward to Brazil, and on those of west tropical Africa, the Indian peninsula, the islands of the Malay Archipelago, New Guinea, Australia, and on those of many of the islands of the south Pacific Ocean.

Section 3. Flowers perfect or unisexual; calyx 5-lobed; ovary superior, 1-celled; ovule solitary, rising from the bottom of the cell; fruit inclosed in the thickened calyx; leaves persistent.

XIV. POLYGONACEÆ.

Trees, with alternate coriaceous stalked leaves, their stipules sheathing the stem. Flowers perfect; calyx 5-lobed; stamens 8; ovary 3-celled; ovule orthotropous. Fruit a nutlet, inclosed in the thickened calyx-tube; seed erect; embryo axillary in ruminate farinaceous albumen; radicle superior, ascending, turned toward the hilum. Of this, the Buckwheat family with thirty widely distributed genera, only Coccolobis is arborescent in North America.

1. COCCOLOBIS P. Br.

Trees or shrubs. Leaves coriaceous, entire, orbicular, ovate, obovate, or lanceolate, petiolate, their stipules inclosing the branch above the node with membranaceous truncate entire brown persistent sheaths. Flowers jointed on ebracteolate pedicels, in 1 or few-flowered fascicles subtended by a minute bract and surrounded by a narrow truncate membranaceous sheath, each pedicel and those above it being surrounded by a similar sheath, the fascicles gathered in elongated terminal and axillary racemes inclosed at the base of the sheath of the nearest leaf and sometimes also in a separate sheath; calyx cup-shaped, the lobes ovate, rounded, thin, white, reflexed after anthesis, and thickening and inclosing the nutlet; stamens with filiform or subulate filaments dilated and united at base into a short discoid cup adnate to the tube of the calyx; anthers ovoid, introrse, 2-celled, the cells parallel, opening longitudinally; ovary free, sessile, 3-angled, contracted into a short stout style, divided into three short or elongated stigmatic lobes. Fruit ovoid or globose, rounded or acute and crowned at apex by the persistent lobes of the calyx, narrowed at base; flesh thin and acidulous, more or less adnate to the thin crustaceous or bony wall of the nutlet often divided on the inner surface near the base into several more or less intrusive plates. Seed subglobose, acuminate at apex, 3–6-lobed; testa membranaceous, minutely pitted, dark red-brown, and lustrous.

Coccolobis is confined to the tropics of the New World, with about one hundred and

twenty species distributed from southern Florida to Mexico, Central America, Brazil, and Peru. It possesses astringent properties sometimes utilized in medicine. Many of the species produce hard dark valuable wood.

Coccolobis, from κοκκος and λοβός, is in allusion to the character of the fruit.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Fruits crowded, in drooping racemes; leaves broadly ovate to suborbicular, cordate at base. 1. **C. uvifera** (D).

Fruits not crowded, in erect or spreading racemes; leaves ovate to oblong-lanceolate. 2. **C. laurifolia** (D).

1. Coccolobis uvifera Jacq. Sea Grape.

Leaves broadly ovate to suborbicular rounded or sometimes short-pointed at apex, deeply cordate at base, with undulate margins, thick and coriaceous, minutely reticulate-venulose, dark green and lustrous above, paler and puberulous below, 4′–5′ long, 5′–6′ wide, with a stout often bright red midrib frequently covered below with pale hairs, and about 5 pairs of conspicuous primary veins red on the upper side, arcuate near the margins and connected by cross veinlets; gradually turning red or scarlet and falling during their second or third

Fig. 307

years; petioles short, stout, flattened, puberulous, abruptly enlarged at base, leaving in falling large pale elevated orbicular or semiorbicular scars; stipular sheath $\frac{1}{8}$′ broad, slightly puberulous, persistent during 2 or 3 years. **Flowers** appearing almost continuously throughout the year on slender puberulous pedicels $\frac{1}{8}$′ long, in 1–6-flowered subsessile fascicles, in terminal and axillary thick-stemmed many-flowered racemes 6′–14′ in length; calyx $\frac{1}{8}$′ across when expanded, the lobes puberulous on the inner surface and rather longer than the red stamens; ovary oblong, with short stigmatic lobes. **Fruit** crowded, in long hanging racemes, ovoid to obovoid, $\frac{3}{4}$′ long, gradually narrowed into a stalk-like base, purple or greenish white, translucent, with thin juicy flesh, and a thin-walled light red nutlet.

A tree, in Florida rarely more than 15° high, with a short gnarled contorted trunk 3°–4° in diameter, stout branches forming a round compact head, and stout terete branchlets, with thick pith, light orange color, marked by oblong pale lenticels, gradually growing darker in their second and third years; frequently a shrub, with semiprostrate stems; in the West Indies often 50° tall. **Bark** about $\frac{1}{16}$′ thick, smooth, light brown and marked by large irregular pale blotches. **Wood** very heavy, hard, close-grained, dark brown or violet color, with thick lighter colored sapwood; sometimes used in cabinet-making.

Distribution. Saline shores and beaches; Florida, from Mosquito Inlet to the southern keys on the east coast, and from Tampa Bay to Cape Sable on the west coast; common on the Bermuda and Bahama Islands, in the Antilles, and in South America from Colombia to Brazil.

2. Coccolobis laurifolia Jacq. Pigeon Plum.

Leaves ovate, ovate-lanceolate or obovate-oblong, rounded or acute at apex, rounded or cuneate at base, with slightly undulate revolute margins, thick and firm, bright green above, paler below, 3′–4′ long, 1½′–2′ wide, with a conspicuous pale midrib and 3 or 4 pairs of remote primary veins connected by prominent reticulate veinlets; petioles stout, flattened, ½′ in length, abruptly enlarged at base; stipular sheath glabrous, ½′ wide. **Flowers** in early spring, on slender pedicels ¼′ long, in few or 1-flowered fascicles on racemes terminal on short axillary branches of the previous year, and 2′–3′ in length; calyx ⅛′ across, the cup-shaped lobes rather shorter than the stamens, with slender yellow filaments enlarged at base, and dark orange-colored anthers; ovary oblong, with elongated stigmatic lobes.

Fig. 308

Fruit in erect or spreading sparsely-fruited racemes, ripening during the winter and early spring, ovoid, narrowed at base, rounded at apex, dark red, ⅓′ long, with thin acidulous flesh and a hard thin-walled light brown nutlet.

A glabrous tree, 60°–70° high, with a tall straight trunk 1°–2° in diameter, spreading branches forming a dense round-topped head, slender terete slightly zigzag branchlets usually contorted and covered with light orange-colored bark, becoming darker and tinged with red in their second or third year. **Wood** heavy, exceedingly hard, strong, brittle, close-grained, rich dark brown tinged with red, with thick lighter colored sapwood; occasionally used in cabinet-making.

Distribution. One of the largest and most abundant of the tropical trees of the seacoast of southern Florida from Cape Canaveral to the keys and on the west coast from Cape Romano to Cape Sable; common on the Bahama Islands, on many of the Antilles, and in Venezuela.

XV. NYCTAGINACEÆ.

Trees with alternate stalked persistent leaves without stipules. Flowers perfect or unisexual; calyx corolla-like, 5-lobed; stamens 5–8; ovule campylotropous. Fruit anthocarpus, crowned by the persistent teeth of the calyx. Seed erect; cotyledons unequal, folded round the soft scanty albumen; radicle short, inferior, turned toward the hilum. A family of about twenty genera widely distributed chiefly in the warmer and tropical parts of the New World, with a single arborescent representative in North America.

1. TORRUBIA Vell.

Glabrous or pubescent unarmed trees or shrubs. Leaves opposite or rarely alternate, entire, short-stalked. Flowers perfect, or rarely unisexual; calyx tubular or funnel-shaped, elongated, 5-lobed, the lobes plaited in the bud, erect or spreading; stamens inserted on the base of the calyx under the ovary, minute or rudimentary in the unisexual pistillate flower; filaments folded in the bud, filiform, unequal, free; anthers oblong, introrse, 2-celled, the cells parallel, opening longitudinally; ovary oblong-ovoid, sessile, 1-celled, gradually narrowed into a columnar style; stigmas capitate, lacerate. Fruit fleshy, cylindric, costate, smooth; utricle elongated, with a thin membranaceous wall confluent with the thin transparent coat of the erect seed.

Torrubia, with about 15 species is confined to tropical America, one species extending into southern Florida. The genus was named in honor of Joseph Torrubia, a Spanish naturalist of the 18th century.

1. Torrubia longifolia Britt. Blolly.

Pisonia longifolia Sarg.

Leaves oblong-obovate, rounded or occasionally emarginate at apex, gradually narrowed at base, 1′–1½′ long, ½′ wide, thick and firm, with slightly thickened undulate margins, light green and glabrous, paler on the lower than on the upper surface, with a stout midrib and

Fig. 309

obscure veins; petioles stout, channeled, ½′ in length. **Flowers** perfect or unisexual, autumnal, greenish yellow, short-pedicellate, in terminal long-stalked few-flowered panicled cymes, with slender divergent branches, the ultimate divisions 2 or 3-flowered; bracts and bractlets minute, acute; calyx funnel-shaped, divided nearly to the middle into acute erect lobes about half as long as the stamens and as long as the style. **Fruit** ripening in the winter or early spring, prominently costate with ten rounded ribs, fleshy, smooth, bright red, ¾′ long; utricle terete, light brown.

A tree, occasionally 30°–50° high, with an erect or inclining trunk, 15′–20′ in diameter, stout spreading branches forming a compact round-topped head, and slender terete branchlets light orange color when they first appear, later often producing numerous short spur-like lateral branchlets, light reddish brown or ashy gray, and marked by large elevated semi-orbicular or lunate leaf-scars; usually much smaller; often shrubby. **Bark** about 1/16′ thick, light red-brown, and broken into thin appressed scales. **Wood** heavy, rather soft, weak, coarse-grained, yellow tinged with brown, with thick darker colored sapwood.

Distribution. Sea-beaches and the shores of salt water lagoons; Cape Canaveral, Florida to the southern keys, attaining its largest size in Florida on Elliott's Key and Old Rhodes Key; on the Bahama Islands and in Cuba.

Subdivision 2. Petalatæ. Flowers with both calyx and corolla (*without a corolla in Lauraceæ, in Liquidambar in Hamamelidaceæ, in Euphorbiaceæ, in some species of Acer, in Reynosia, Condalia, and Krugiodendron in Rhamnaceæ, in Fremontia in Sterculiaceæ, in Calyptranthes in Myrtaceæ, and in Conocarpus in Combretaceæ*).

Section 1. Polypetalæ. Corolla of separate petals.

A. Ovary superior (*partly inferior in Hamamelidaceæ; inferior in Malus, Sorbus, Cratægus and Amelanchier in Rosaceæ*).

XVI. MAGNOLIACEÆ.

Trees or shrubs, with watery juice, branchlets lengthening by large terminal or the flower-bearing branchlets by upper axillary buds, the other axillary buds obtuse, flattened, and rudimentary, bitter aromatic bark, and thick fleshy roots. Leaves alternate, conduplicate and inclosed in their stipules in the bud, feather-veined, petiolate. Flowers perfect, large, solitary, terminal, pedicellate, inclosed in the bud in a stipular caducous spathe; sepals and petals imbricated in the bud, inserted under the ovary, deciduous; stamens and pistils numerous, imbricated in many ranks, the stamens below the pistils on the surface of an elongated receptacle ripening into a compound fruit of 1–2-seeded follicles or samara: ovules 2, collateral, anatropous. Four of the ten genera of the Magnolia family are represented in North America; of these two are arborescent.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT GENERA.

Anthers introrse; mature carpels, fleshy, opening on the back at maturity, persistent; seed-coat thick, pulpy, and bright scarlet; leaves entire, or auriculate at base. 1. **Magnolia.**

Anthers extrorse; mature carpels dry, indehiscent, deciduous; seed-coat dry and coriaceous; leaves lobed or truncate. 2. **Liriodendron.**

1. MAGNOLIA L. Magnolia.

Trees, with ashy gray or brown smooth or scaly bark, branchlets conspicuously marked by large horizontal or longitudinal leaf-scars and by narrow stipular rings, and large terete acuminate or often obtusely-pointed more or less gibbous winter-buds usually broadest at the middle, their scales large membranaceous stipules adnate to the base of the petioles and deciduous with the unfolding of each successive leaf, the petiole of the outer stipule rudimentary, adnate on the straight side of the bud, and marked at its apex by the scar left by the falling of the last leaf of the previous season. Leaves entire, sometimes auriculate, persistent or deciduous, often minutely punctate, their numerous primary veins arcuate and more or less united within the margins. Flowers appearing in the American species after the leaves, their stipular spathes thin and membranaceous; sepals 3, spreading or reflexed; petals 6–12 in series of 3's, concave, erect or spreading; stamens early deciduous, their filaments shorter than the 2-celled introrse anthers and terminating in apiculate fleshy connectives; ovary sessile, 1-celled; style short, recurved, stigmatic on the inner face; ovules horizontal. Fruit a scarlet or rusty brown cone formed of the coalescent 2-seeded drupaceous persistent follicles opening on the back; seeds suspended at maturity by long thin cords of unrolled spiral vessels; seed-coat thick, drupaceous, the outer portion becoming fleshy and at maturity pulpy, red or scarlet, the inner crustaceous; embryo minute at

the base of the fleshy homogeneous albumen, its radicle next the hilum; cotyledons short and spreading.

Magnolia with about thirty species is confined to eastern North America, southern Mexico, and eastern and southern Asia, seven species growing naturally in the United States. All the parts are slightly bitter and aromatic, and the dried flower-buds are sometimes used in medicine. Several species from eastern Asia and their hybrids producing flowers before the appearance of the leaves are favorite garden plants in the United States.

The genus is named in honor of Pierre Magnol (1638–1715), professor of botany at Montpellier.

CONSPECTUS OF NORTH AMERICAN SPECIES.

Styles deciduous from the follicles of the fruit; petals greenish or yellow; winter-buds silky tomentose.
- Petals greenish; branchlets glabrous. 1. **M. acuminata** (A, C).
- Petals canary yellow; branchlets pubescent. 2. **M. cordata** (C).

Styles persistent on the follicles of the fruit.
- Petals white.
  - Leaves coriaceous, persistent; fruit and branchlets tomentose. 3. **M. grandiflora** (C).
  - Leaves thin, deciduous (semipersistent in 4).
    - Leaves cuneate at base.
      - Leaves scattered along the branches, pale and pubescent below; winter-buds glabrous or silky pubescent. 4. **M. virginiana** (A. C).
      - Leaves crowded at the ends of the flowering branches, green and glabrous below; winter-buds glabrous. 5. **M. tripetala** (A, C).
    - Leaves cordate at the narrow base; fruit tomentose; winter-buds hoary-tomentose. 6. **M. macrophylla** (C).
- Petals pale yellow or creamy white; leaves obovate-spathulate, auriculate, crowded at the ends of the flowering branches; winter-buds glabrous.
  - Leaves acute; petals pale yellow; tips of the mature carpels elongated, straight or incurved. 7. **M. Fraseri** (A, C).
  - Leaves bluntly pointed; petals creamy white; tips of the mature carpels short, incurved. 8. **M. pyramidata** (C).

1. Magnolia acuminata L. Cucumber-tree. Mountain Magnolia.

Leaves oblong-ovate, oblong-obovate or elliptic, abruptly short-pointed at apex, rounded, cuneate or rarely slightly cordate at base, when they unfold densely villose below and slightly villose above, and at maturity thin, yellow-green and glabrous on the upper surface, paler and glabrous or villose-pubescent on the lower surface, 6′–10′ long, and 4′–6′ wide, with often undulate margins; turning dull yellow or brown in the autumn before falling; petioles slender, pubescent early in the season, becoming glabrous, 1′–1½′ in length. **Flowers** on hairy soon glabrous pedicels ½′–¾′ long, bell-shaped, green or greenish yellow covered with a glaucous bloom; sepals membranaceous, acute, 1′–1½′ long, soon reflexed; petals 6, ovate or obovate, concave, pointed, erect, 2½′–3′ long, those of the outer row rarely more than 1′ wide and much wider than those of the inner row. **Fruit** ovoid or oblong, often curved, glabrous, dark red, 2½′–3′ long, rarely more than 1′ thick; **seeds** obovoid, acute, compressed, about ½′ long.

A pyramidal tree, 60°–90° high, with a trunk 3°–4° in diameter, comparatively small branches spreading below and erect toward the top of the tree, and slender branchlets coated at first with soft pale caducous hairs, soon bright red-brown, lustrous, and marked by numerous small pale lenticels, turning gray during their third season. **Winter-buds:** terminal, oblong-ovoid, acuminate, thickly covered with long lustrous white hairs, ½′–⅝′ long, and about three times as long as the obtuse compressed lateral buds nearly surrounded by the narrow elevated leaf-scars conspicuously marked by a double row

of large fibro-vascular bundle-scars. **Bark** $\frac{1}{3}'$–$\frac{1}{2}'$ thick, furrowed, dark brown, and covered by numerous thin scales. **Wood** light, soft, not strong, close-grained, durable, and light yellow-brown, with thin lighter colored often nearly white sapwood of usually 25–30 layers of annual growth; occasionally manufactured into lumber used for flooring and cabinet-making.

Fig. 310

Distribution. Low mountain slopes and rocky banks of streams; southern Ontario, western New York, central to western Pennsylvania, southern Ohio, Indiana and Illinois, and along the Appalachian Mountains to northern Georgia and to central Kentucky and Tennessee; banks of the Savannah River above Augusta, and in the neighborhood of Lumpkin, Stewart County, Georgia; northern Alabama, northeastern, northwestern and south-central Mississippi; Eagle Rock, Barry County, and on bluffs of the Mississippi River, Cape Girardeau County, Missouri, and Baxter County, Arkansas; in eastern Oklahoma (Page, Le Flore County); in West Feliciana Parish, Louisiana, represented by var. *ludoviciana* Sarg. differing in its broadly obovate, oval or ovate leaves, and in its larger flowers, $3\frac{1}{2}'$–$4'$ long, the outer petals $1\frac{1}{2}'$ wide. Rare at the north; most abundant and of its largest size at the base of the high mountains of the Carolinas and Tennessee up to altitudes of 4000°.

Often planted as an ornamental tree in the eastern states and in northern and central Europe.

2. Magnolia cordata Michx.

Magnolia acuminata var. *cordata* Sarg.

Leaves oblong-obovate to elliptic, abruptly short-pointed or rounded at apex, gradually narrowed and cuneate, broad-cuneate or rarely rounded at base, when they unfold villose-pubescent more densely on the lower than on the upper surface, at maturity dark green, lustrous and glabrous above, paler and covered below with short matted pale hairs, $4'$ or $5'$ long, $2\frac{1}{2}'$–$3\frac{1}{2}'$ wide, with a slender yellow midrib and primary veins; remaining green until late in the autumn and turning brown and falling after severe frost; petioles slender, covered when they first appear with matted silky white hairs, becoming glabrous, $\frac{1}{2}'$–$\frac{3}{4}'$ in length. **Flowers** on stout pedicels, $\frac{1}{4}'$–$\frac{1}{3}'$ long and covered with long silky white hairs, cup-shaped, bright canary yellow; sepals ovate, acute, soon reflexed; petals 6, erect and spreading, $1\frac{1}{2}'$–$1\frac{3}{4}'$ long, $\frac{1}{2}'$–$\frac{3}{4}'$ wide. **Fruit** oblong, often curved, glabrous, dark red, $1'$–$1\frac{1}{2}'$ long, $\frac{1}{2}'$–$\frac{3}{4}'$ thick.

A shrub, 4°–8° high, flowering freely when not more than half that size; or in gardens a tree sometimes 20°–30° tall with a trunk 12′–15′ in diameter, spreading branches forming a

round-topped head, and slender dark dull red-brown branchlets thickly covered during two years with short pubescence and marked by small pale lenticels. **Winter-buds** oblong-obovate, often falcate, bluntly pointed, thickly covered with matted pale hairs, the terminal $\frac{1}{2}'$ long and $\frac{1}{4}'$ thick, the axillary $\frac{1}{6}'$–$\frac{1}{4}'$ in length and nearly surrounded by the narrow

Fig. 311

leaf-scars marked by an irregular row of minute fibro-vascular bundle-scars. **Bark** dark brown, and covered with small closely appressed scales.

Distribution. Dry Oak-woods, valley of the Savannah River, Georgia; Spears Plantation six miles south and Goshen Plantation sixteen miles south of Augusta, Richmond County, near Mayfield, Hancock County, and Bath, Richmond County. Often cultivated, and preserved in gardens for more than a century; not rediscovered as a wild plant until 1913 (*L. A. Berckmans*); hardy as far north as eastern Massachusetts.

3. Magnolia grandiflora L. Magnolia.

Magnolia fœtida Sarg.

Leaves elliptic to oblong-obovate or ovate, acute and bluntly pointed or acuminate at apex, cuneate at base, coriaceous, bright green and shining above, more or less densely coated below with rusty tomentum, 5′–8′ long, 2′–3′ wide, with a prominent midrib and primary veins, deciduous in the spring at the end of their second year; petioles stout, rusty-tomentose, 1′–2′ in length. **Flowers** on stout hoary-tomentose pedicels $\frac{1}{2}'$–1′ long, opening from April or May until July or August, fragrant, 7′–8′ across, the petaloid sepals and 6 or sometimes 9 or 12 petals abruptly narrowed at base, oval or ovate, those of the inner ranks often somewhat acuminate, concave, and coriaceous, 3′–4′ long and $1\frac{1}{2}'$–2′ wide; base of the receptacle and lower part of the filaments bright purple. **Fruit** ovoid or oval, rusty brown, covered while young with thick lustrous white tomentum, at maturity rusty-tomentose, 3′–4′ long, $1\frac{1}{2}'$–$2\frac{1}{2}'$ thick; **seeds** obovoid or triangular-obovoid, more or less flattened, $\frac{1}{2}'$ long.

A tree, of pyramidal habit, 60°–100° or rarely 120°–135° high, with a tall straight trunk 2°–3° or occasionally 4°–$4\frac{1}{2}$° in diameter, rather small spreading branches, and branchlets hoary-tomentose at first, slightly tomentose in their second year, and much roughened by the elevated leaf-scars displaying a marginal row of conspicuous fibro-vascular bundle-scars. **Winter-buds** pale or rusty-tomentose, the terminal 1′–$1\frac{1}{2}'$ in length. **Bark** $\frac{1}{2}'$–$\frac{3}{4}'$ thick, gray or light brown, and covered with thin appressed scales rarely more than 1′ long. **Wood** hard, heavy, creamy white, soon turning brown with exposure, hardly distinguishable from the sapwood of 60–80 layers of annual growth; largely used in basket and crate making.

Distribution. Rich moist soil on the borders of river swamps and Pine-barren ponds, or rarely on high rolling hills; coast of North Carolina southward to De Soto County, Florida, extending across the peninsula, and in the neighborhood of the coast through the other Gulf states to the valley of the Brazos River, Texas, ranging inland to central Missis-

Fig. 312

sippi and to southern Arkansas, and northward on the bluffs of the lower Mississippi River to the mouth of the Yazoo River, Mississippi; best developed and most abundant on the bluff formation of the lower Mississippi River, and of its largest size in West Feliciana Parish, Louisiana.

Largely cultivated as an ornamental tree in all countries of temperate climate; in the eastern United States precariously hardy as far north as Trenton, New Jersey. Numerous varieties, differing in the form of the leaf and in the duration of the flowering period, have appeared in European nurseries; of these, the most distinct is the variety *exoniensis* Loud., with a rather fastigiate habit and broadly elliptic leaves densely clothed with rusty tomentum on the lower surface; this variety begins to flower when only a few feet high.

4. Magnolia virginiana L. Sweet Bay. Swamp Bay.

Magnolia glauca L.

Leaves oblong or elliptic and obtuse or oblong-lanceolate, covered when they unfold with long white silky deciduous hairs, at maturity bright green, lustrous and glabrous on the upper surface, finely pubescent and pale or nearly white on the lower surface, 4′–6′ long, 1½′–3′ wide, with a conspicuous midrib and primary veins; falling in the north late in November and in early winter, at the south remaining on the branches with little change of color until the appearance of the new leaves in the spring; petioles slender, ½′–¾′ in length. **Flowers** on slender glabrous pedicels ½′–¾′ long, creamy white, fragrant, globular, 2′–3′ across, continuing to open during several weeks in spring and early summer; sepals membranaceous, obtuse, concave, shorter than the 9–12, obovate often short-pointed concave petals. **Fruit** ellipsoidal, dark red, glabrous, 2′ long and ½′ thick; **seeds** obovoid, oval, or suborbicular, much flattened, ¼′ in length.

A slender tree, 20°–30° high, with a trunk rarely more than 15′–20′ in diameter, with small mostly erect ultimately spreading branches and slender bright green branchlets hoary-pubescent when they first appear, soon glabrous, marked by narrow horizontal pale lenticels, gradually turning bright red-brown in their second summer; usually a low shrub. **Winter-buds** covered with fine silky pubescence, the terminal ½′–¾′ long.

Distribution. Deep swamps; Magnolia, Essex County, Massachusetts, Long Island, New York, and southward from New Jersey generally in the neighborhood of the coast to southeastern Virginia and occasionally in North and South Carolina and Georgia; in Pennsylvania as far west as the neighborhood of Chambersburg, Franklin County. In the southern states usually replaced by the var. *australis* Sarg., differing in the thick silky white pubescence on the pedicels and branchlets. **Leaves** persistent without change of color

Fig. 313

until spring, elliptic to ovate, oblong-obovate or rarely lanceolate, 1′–4′ wide; petioles puberulous, pubescent or tomentose.

A tree, 60°–90° high, with a tall straight trunk occasionally 3° in diameter, small short branches forming a narrow round-topped head, and branchlets usually becoming glabrous in their second year; in southern Florida often much smaller and on the Everglade Keys shrubby, and generally not more than 10° tall. **Wood** soft, light brown tinged with red, with thick creamy white sapwood of 90–100 layers of annual growth; used in the southern states in the manufacture of broom handles and other articles of woodenware.

Distribution. Borders of Pine-barren ponds, in shallow swamps and on rich hummocks usually in the neighborhood of the coast; swamps of the lower Cape Fear River near Wilmington, New Hanover County, North Carolina, to southern Florida; common in the interior of the Florida peninsula, and westward to the valley of the Nueces River, Texas; ranging inland to Cuthbert, Randolph County, western Georgia, to Tuskegee and Selma, Alabama, Tishomingo County, northeastern Mississippi, and to Winn and Natchitoches Parishes, western Louisiana, and to the neighborhood of Malvern, Hot Spring County, Arkansas (*E. J. Palmer*); less abundant west of the Mississippi River than eastward.

The northern form is often cultivated as a garden plant in the eastern states and in Europe.

× *Magnolia major* or *Thompsoniana*, a probable hybrid between *Magnolia virginiana* and *Magnolia tripetala*, raised in an English nursery a century ago, and still a favorite garden plant, is intermediate in character between these species.

5. Magnolia tripetala L. Umbrella-tree. Elkwood.

Leaves obovate-lanceolate, narrowed at the ends, acute or bluntly pointed at apex, when they unfold nearly glabrous above, covered below with thick silky caducous tomentum, at maturity membranaceous, glabrous, 18′–20′ long, 8′–10′ wide, with a thick prominent midrib and numerous slender primary veins; falling in the autumn with little change of color; petioles stout, 1′–1½′ in length. **Flowers** on slender glabrous pedicles covered with a glaucous bloom and 2′–2½′ long, cup-shaped, white; sepals narrowly obovate, 5′–6′ long,

$1\frac{1}{2}'$ wide, thin, light green, becoming reflexed; petals 6 or 9, concave, coriaceous, ovate, short-pointed, erect, those of the outer row 4′–5′ long and sometimes 2′ wide, much longer and broader than those of the inner rows; filaments bright purple. **Fruit** ovoid, glabrous, $2\frac{1}{2}'$–4′ long, rose color when fully ripe; **seeds** obovoid, $\frac{1}{2}'$ long.

A tree, 30°–40° high, with a straight or often inclining trunk rarely more than 18′ in diameter, stout irregularly developed contorted branches wide-spreading nearly at right angles with the stem or turning up toward the ends and growing parallel with it, and stout brittle branchlets green during their first season, becoming in their first winter bright reddish brown, very lustrous, and marked by occasional minute scattered pale lenticels, and by the large oval horizontal slightly raised leaf-scars with scattered fibro-vascular bundle-scars, brown during their second and gray during their third season; generally much smaller, sometimes surrounded by several stems springing from near the base of the trunk and

Fig. 314

growing into a large bush surmounted by the head of the central stem. **Winter-buds**: terminal, acute or bluntly pointed, purple, glabrous, covered with a glaucous bloom, usually about 1′ long; axillary globose, the color of the branch. **Bark** $\frac{1}{2}'$ thick, light gray, smooth, and marked by many small bristle-like excrescences. **Wood** light, soft, close-grained, not strong, light brown, with creamy white sapwood of 35–40 layers of annual growth.

Distribution. Deep rather moist rich soil along the banks of mountain streams or the margins of swamps, and widely distributed in the Appalachian Mountain region, but nowhere very common; valley of the Susquehanna River, Pennsylvania (Lancaster and York Counties), and Jackson County, Ohio, to southern Alabama, middle Kentucky and Tennessee, and northeastern Mississippi; in central and southwestern Arkansas; and in southeastern Oklahoma (near Page, Le Flore County, *G. W. Stevens*), extending in Virginia and North Carolina nearly to the coast; of its largest size in the valleys along the western slopes of the Great Smoky Mountains in Tennessee up to altitudes of 2000°.

Often cultivated as an ornamental tree in the northern states, and in northern and central Europe.

6. Magnolia macrophylla Michx. Large-leaved Cucumber-tree.

Leaves obovate or oblong, acute or often abruptly narrowed and acute or rounded at apex, narrowed and cordate at base, bright green and glabrous on the upper surface, silvery

gray and pubescent, especially along the stout midrib and primary veins on the lower surface, 20′–30′ long, 9′–10′ wide; falling in the autumn with little change of color; petioles stout, 3′–4′ in length, at first tomentose, becoming pubescent. **Flowers** on stout hoary-tomentose pedicels 1′–1½′ long, soon becoming glabrous or puberulous, cup-shaped, fragrant, 10′–12′ across; sepals membranaceous, ovate or oblong, rounded at apex, much narrower than the 6 ovate concave thick creamy white petals with a rose colored blotch at base, 6′–7′ long and 3′–4′ wide, at maturity reflexed above the middle, those of the inner row narrower and often somewhat acuminate. **Fruit** ovoid to nearly globose, pubescent, 2½′–3′ long, bright rose color when fully ripe; **seeds** obovoid, compressed, ⅔′ long.

A tree, 30°–50° high, with a straight trunk 18′–20′ in diameter, stout wide-spreading branches forming a broad symmetrical round-topped head, and stout brittle branchlets hoary-tomentose when they first appear, light yellow-green, pubescent, and conspicuously

Fig. 315

marked during their first winter by the large irregularly shaped sometimes longitudinal slightly raised leaf-scars with many scattered fibro-vascular bundle-scars, turning reddish brown during their second and gray during their third season. **Winter-buds**: terminal, bluntly pointed, covered with a thick coat of snowy white tomentum, 1¾′–2′ long, ½′–¾′ thick; lateral, much flattened, brownish, pubescent, ⅛′–¼′ long. **Bark** generally less than ¼′ thick, smooth, light gray, divided on the surface into minute scales. **Wood** hard, close-grained, light, not strong, light brown, with thick light yellow sapwood of about 40 layers of annual growth.

Distribution. Sheltered valleys in deep rich soil; nowhere common, and growing generally in isolated groups of a few individuals; Piedmont region of central North Carolina to middle and western Florida, southern Alabama, southern and northeastern Mississippi to the valley of the Green River, Kentucky; in eastern and western Louisiana; probably most abundant in south-central Mississippi.

Occasionally cultivated as an ornamental tree in the eastern states, and in the temperate countries of Europe; hardy as far north as eastern Massachusetts.

7. Magnolia Fraseri Walt. Mountain Magnolia. Long-leaved Cucumber-tree.

Leaves obovate-spatulate, acute or bluntly pointed at apex, cordate and conspicuously auriculate at base, bright green and often marked on the upper surface when young with red along the principal veins, glabrous, 10′–12′ long, 6′–7′ wide, or on vigorous young plants sometimes of twice that size; falling in the autumn without change of color; petioles slender, 3′–4′ in length. **Flowers** on stout glabrous pedicels covered with a glaucous bloom and 1′–1½′ long, pale yellow, sweet scented, 8′–10′ across; sepals narrowly obovate,

rounded at apex, 4′–5′ long, deciduous almost immediately after the opening of the bud, shorter than the 6 or 9 obovate acuminate membranaceous spreading petals contracted below the middle, those of the inner rows narrower and conspicuously narrowed below. **Fruit** oblong, glabrous, bright rose-red when fully ripe, 4′–5′ long, 1½′–2′ thick, the mature carpels ending in long subulate persistent tips; **seeds** obovoid, compressed, ⅝′ long.

A tree, 30°–40° high, with a straight or inclining trunk 12′–18′ in diameter, often undivided for half its length or separating at the ground into a number of stout diverging stems, regular wide-spreading or more or less contorted and erect branches, and stout brittle branchlets soon becoming bright red-brown, lustrous, marked by numerous minute pale lenticels and in their first winter by the low horizontal leaf-scars with crowded compressed fibro-vascular bundle-scars, and grayish in their second year. **Winter-buds:** ter-

Fig. 316

minal, glabrous, purple, 1½′–2′ long, ½′ thick; axillary, minute and obtuse. **Bark** rarely more than ⅓′ thick, dark brown, smooth, covered by small excrescences, or on old trees broken into minute scales. **Wood** light, soft, close-grained, not strong, light brown, with thick creamy white sapwood of 30–40 layers of annual growth.

Distribution. Valleys of the streams of the southern Appalachian Mountains from southwestern Virginia and northeastern Kentucky to northern Georgia; in northern Alabama and in West Feliciana Parish, Louisiana (Laurel Hill, *R. S. Cocks*); in South Carolina eastward to the neighborhood of Aiken, Aiken County; probably most abundant and of largest size on the upper waters of the Savannah River in South Carolina up to altitudes of 4000°.

Occasionally cultivated as an ornamental plant in the eastern states, and in the temperate countries of Europe; hardy as far north as eastern Massachusetts.

8. Magnolia pyramidata Pursh.

Leaves obovate-spatulate, the apex usually abruptly narrowed into a short blunt point, auriculate at base, with more or less spreading lobes, thin, glabrous, light yellow-green on the upper, pale and glaucous on the lower surface, particularly while young, 5½′–8½′ long, from 3½′–4½′ wide, with a slender yellow midrib, numerous slender forked primary veins and conspicuously reticulate veinlets; petioles slender, 1¼′–2½′ in length. **Flowers** creamy white, 3½′–4′ across when fully expanded; sepals oblong-obovate, abruptly narrowed to the short-pointed apex, much shorter than the oblong-acuminate petals gradually narrowed from near the middle to the base. **Fruit** oblong, 2′–2½′ long, bright rose

color, the mature carpels ending in short incurved persistent tips; seeds ovoid, compressed.

A slender tree, 20°–30° high, with ascending branches, slender branchlets bright red-brown and marked by small pale lenticels and by the small low oval leaf-scars with many crowded fibro-vascular bundle-scars, later becoming ashy gray.

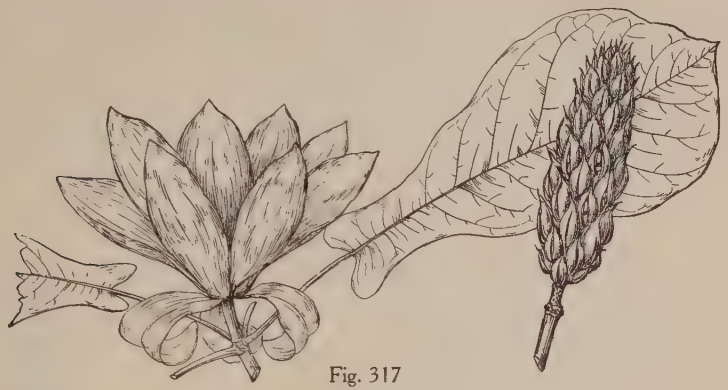

Fig. 317

Distribution. Low rich soil in the neighborhood of streams; near Cuthbert, Randolph County, Georgia; near Mariana, Jackson County, and Bristol, Liberty County, Florida; valleys of the Choctawhatchee River, Dale County, and of the Pea River, Coffee County, and near Selma, Dallas County, Alabama; rare and local.

Occasionally cultivated as an ornamental tree in western Europe.

2. LIRIODENDRON L.

Trees, with deeply furrowed brown bitter bark, and slender branchlets marked by elevated leaf-scars and narrow stipular rings, and compressed obtuse winter-buds, their scales membranaceous stipules joined at the edges, accrescent, strap-shaped, often slightly falcate, oblique at the unequal base, tardily deciduous after the unfolding of the leaf. Leaves recurved in the bud by the bending down of the petiole near the middle, bringing the apex of the blade to the base of the bud, sinuately 4-lobed, heart-shaped, truncate or slightly cuneate at base, truncate at apex by a broad shallow sinus, and minutely apiculate. Flowers appearing after the unfolding of the leaves, cup-shaped, conspicuous, inclosed in the bud in a 2-valved stipular membranaceous caducous spathe; sepals spreading or reflexed, ovate-lanceolate, concave, greenish white, early deciduous; petals erect, rounded at base, early deciduous; filaments filiform, half as long as the linear 2-celled extrorse anthers adnate to the outer face of the connective terminating in a short fleshy point; pistils imbricated on the elongated sessile receptacle into a spindle-shaped column; ovary inserted by a broad base; style narrowly acuminate, laterally flattened, appressed; stigmas short, recurved at the summit; ovules 2, suspended from near the middle of the ventral suture. Fruit a narrow light brown cone formed of the closely imbricated dry and woody indehiscent carpels consisting of a laterally compressed 4-ribbed pericarp, the lateral ribs confluent into the margins of the large wing-like lanceolate compressed style marked vertically by a thin sutural line, the carpels deciduous when ripe in the autumn from the slender elongated axis of the fruit persistent on the branch during the winter. Seeds suspended, 2 or single by abortion; testa thin, coriaceous, and marked by a narrow prominent raphe; embryo minute at the base of the fleshy albumen, its radicle next the hilum.

Liriodendron, widely distributed in North America and Europe during the cretaceous

period, is now represented by two species, one in eastern North America, the other *L. chinensis* Sarg. in central China.

Liriodendron, from λιριον and δένδρον, is descriptive of the lily-like flower.

1. Liriodendron Tulipifera L. Yellow Poplar. Tulip-tree.

Leaves dark green and shining on the upper, paler on the lower surface, 5′–6′ long and broad; turning clear yellow in the autumn before falling; petioles slender, angled, 5′–6′ in length. **Flowers** 1½′–2′ deep, on slender pedicels ¾′–1′ long; petals green conspicuously marked with orange at base. **Fruit** 2½′–3′ long, about ½′ thick, ripening late in September and in October, the mature carpels ½′–1½′ long and about ¼′ wide.

A tree, sometimes nearly 200° high, with a straight trunk 8°–10° in diameter, destitute of branches for 80°–100° from the ground, short, comparatively small branches forming a

Fig. 318

narrow pyramidal, or in old age a broader spreading head, and slender branchlets light yellow-green and often covered with a glaucous bloom during their first summer, reddish brown, lustrous, and marked during their first winter by many small pale lenticels and roughened by the elevated orbicular or semiorbicular leaf-scars marked by numerous small scattered fibro-vascular bundle-scars, and dark gray during their third year. **Winter-buds** dark red covered by a glaucous bloom, the terminal ½′ long, much longer than the lateral buds. **Bark** thin and scaly on young trees, becoming deeply furrowed, brown, and 1′–2′ thick. **Wood** light, soft, brittle, not strong, easily worked, light yellow or brown, with thin creamy white sapwood; largely manufactured into lumber used in construction, the interior finish of houses, boatbuilding, and for shingles, brooms, and woodenware. The intensely acrid bitter inner bark, especially of the roots, is used domestically as a tonic and stimulant, and hydrochlorate of tulipiferine, an alkaloid separated from the bark, possesses the property of stimulating the heart.

Distribution. Deep rich rather moist soil on the intervales of streams or on mountain slopes; Worcester County, Massachusetts, to southwestern Vermont (Pownal, Bennington County), and westward to southern Ontario, southern Michigan and northeastern Missouri, and southward to Orange County (Rock Spring Run), Florida, southern Alabama, Mississippi and Louisiana, southeastern Missouri and northeastern Arkansas; most abundant and of its largest size in the valleys of the lower Ohio basin, and on the slopes of the mountains of North Carolina and Tennessee up to altitudes of 5000°.

Often cultivated as an ornamental tree in the eastern states, and in western and central Europe. A fastigiate form (var. *pyramidata* Lav.) is occasionally cultivated.

XVII. ANNONACEÆ.

Trees or shrubs, with watery juice, slender terete branchlets marked by conspicuous leaf-scars, and fleshy roots. Leaves alternate, conduplicate in the bud, entire, feather-veined, petiolate, without stipules. Flowers perfect, solitary, axillary or opposite the leaves; sepals 3, valvate in the bud; petals 6, in 2 series, imbricated or valvate in the bud; stamens numerous, inserted on the subglobose or hemispheric receptacle, with distinct filaments shorter than their fleshy connectives terminating in a broad truncate glandular appendage; anthers introrse, 2-celled, opening longitudinally; pistils inserted on the summit of the receptacle; ovary 1-celled; ovules 1 or many, anatropous. Fruit baccate or compound. Seeds inclosed in an aril; seed-coat thin, crustaceous, smooth, brown, and lustrous; albumen ruminate, deeply penetrated by the folds of the inner layer of the seed-coat; embryo minute; radicle next the hilum. Two of the forty-eight or fifty genera of the Custard-apple family, confined almost exclusively to the tropics and more numerous in the Old World than in the New, occur in North America.

CONSPECTUS OF THE NORTH AMERICAN GENERA.

Petals imbricated in the bud; ovules numerous; fruit developed from one pistil. 1. **Asimina.**
Petals valvate in the bud; ovule solitary; fruit developed from several confluent pistils. 2. **Anona.**

1. ASIMINA Adans.

Trees or shrubs, emitting a heavy disagreeable odor when bruised, with minute buds covered with cinereo-pubescent caducous scales, and branchlets marked by conspicuous leaf-scars. Leaves membranaceous, reticulate-venulose, deciduous. Flowers, solitary pedicellate, nodding; sepals ovate, smaller than the petals, green, deciduous; petals imbricated in the bud, hypogynous, sessile, ovate or obovate-oblong, reticulate-veined, accrescent, the three exterior alternate with the sepals, spreading, those of the interior row opposite the sepals, erect, and much smaller than those of the outer row; stamens linear-cuneate, densely packed on the receptacle; filaments shorter than the fleshy connective; anther-cells separated on the connective; pistils 3–15, sessile on the summit of the receptacle, projecting from the globular mass of stamens; ovary 1-celled; style oblong, slightly recurved toward the apex and stigmatic along the margin; ovules 4–20, horizontal, 2-ranked on the ventral suture, the raphe toward the suture. Fruit baccate, sessile or stipitate, oval or oblong, smooth. Seeds in 1 or 2 ranks, ovoid, apiculate, compressed, marked at the base by a large pale hilum.

Asimina is confined to eastern North America. Six species are distinguished; of these one is a small tree; the others are low shrubs of the south Atlantic and Gulf regions.

Asimina is from *Asiminier*, the old colonial name of the French in America for the Pawpaw.

1. Asimina triloba Dunal. Pawpaw.

Leaves obovate-lanceolate, sharp-pointed at apex, gradually and regularly narrowed to the base, when they unfold covered below with short rusty brown caducous tomentum and slightly pilose above, and at maturity light green on the upper surface, pale on the lower surface, 10′–12′ long, 4′–6′ wide, with a prominent midrib and primary veins. **Flowers** nearly 2′ across when fully grown, on stout club-shaped pedicels from axils of the leaves of the previous year, 1′–1½′ long and covered with long scattered rusty brown hairs; sepals ovate, acuminate, pale green, densely pubescent on the outer surface; petals green at first, covered with short appressed hairs, gradually turning brown and at maturity deep vinous red and conspicuously venulose, those of the outer row broadly ovate, rounded or pointed at apex, reflexed at maturity above the middle and 2 or 3 times longer than the sepals, those of the inner row pointed, erect, their base concave, glandular, nectariferous, marked

by a broad band of a lighter color. **Fruit** attached obliquely to the enlarged torus, oblong, nearly cylindric, rounded or sometimes slightly pointed at the ends, more or less falcate, often irregular from the imperfect development of some of the seeds, 3′–5′ long, 1′–1½′ in diameter, greenish-yellow, becoming when fully ripe in September and October dark brown or almost black, with pale yellow or nearly white barely edible flesh on some plants and on others with orange-colored succulent flesh; **seeds** separating readily from the aril, 1′ long, ½′ broad, rounded at the ends.

A shrub or low tree, sometimes 35°–40° high, with a straight trunk rarely exceeding a foot in diameter, small spreading branches, and slender glabrous or rusty pubescent, light

Fig. 319

brown branchlets tinged with red and marked by longitudinal parallel or reticulate narrow shallow grooves. **Winter-buds** acuminate, flattened, ⅛′ long, and clothed with rusty brown hairs. **Bark** rarely more than ⅛′ thick, dark brown, marked by large ash-colored blotches, covered by small wart-like excrescences and divided by numerous shallow reticulate depressions. **Wood** light, soft and weak, coarse-grained, spongy, light yellow shaded with green, with thin darker colored sapwood of 12–20 layers of annual growth. The inner bark stripped from the branches in early spring is used by fishermen of western rivers for stringing fish. The sweet and luscious wholesome fruit is sold in large quantities in the cities and towns in those parts of the country where the tree grows naturally.

Distribution. Deep rich moist soil; western New Jersey and western New York (Greece, Monroe County) to the northern shores of Lake Ontario, westward to southern Michigan, southwestern Iowa, southeastern Nebraska, eastern Kansas and eastern Oklahoma, and southward to northern Florida (Clay and Taylor Counties), central Alabama, and through Mississippi and Louisiana to eastern Texas (near Marshall, Harrison County, and Dennison, Grayson County); comparatively rare in the region adjacent to the Atlantic seaboard; very common in the Mississippi valley, forming thick forest undergrowth on rich bottomlands, or thickets many acres in extent.

Occasionally cultivated in the eastern states, and hardy as far north as eastern Massachusetts; interesting as the most northern representative of the Custard-apple family and its only species extending far beyond the tropics.

2. ANNONA L.

Trees or shrubs, with glandular often reticulated bark, terete branchlets marked by conspicuous leaf-scars, and often pubescent during their first season. Leaves coriaceous, often

glandular-punctate, persistent or tardily deciduous. Flowers nodding on bracted pedicels; calyx small, 3-lobed, green, deciduous; petals 6 in 2 series, valvate in the bud, hypogynous, sessile, ovate, concave, 3-angled at apex, thick and fleshy, white or yellow, the exterior alternate with the lobes of the calyx, those of the inner row often much smaller than those of the outer row; stamens club-shaped, densely packed on the receptacle; filaments shorter than the fleshy connective; anther-cells confluent; pistils sessile on the receptacle, free or united; ovary 1-celled; style sessile or slightly stipitate, oblong, stigmatic on the inner face; ovule 1, erect; raphe ventral. Fruit compound, many-celled, fleshy, ovoid or globose, many-seeded. Seeds ovoid to ellipsoidal; cotyledons appressed.

Of the fifty species of Anona widely distributed in the tropics of the two worlds, a single species reaches the coast of southern Florida. Of exotic species, *Annona muricata* L., the Soursop and *Annona reticulata* L., of the West Indies, and *Annona cherimola* Mill., of western tropical America, are now occasionally cultivated as fruit-trees in Florida.

Annona is the name given by early authors to the Soursop.

1. Annona glabra L. Pond Apple.

Annona palustris Small, not L.

Leaves elliptic or oblong, acute, tapering or rounded at base, bright green on the upper, paler on the lower surface, coriaceous, 3′–5′ long, 1½′–2′ wide, with a prominent midrib;

Fig. 320

deciduous late in the winter; petioles, stout ½′ in length. **Flowers** nodding on short stout pedicels thickened at the ends, opening in April from an ovoid 3-angled bud; divisions of the calyx broad-ovate, acute; petals connivent, acute, concave, pale yellow or dirty white, those of the outer row marked on the inner surface near the base by a bright red spot, and broader and somewhat longer than those of the inner row. **Fruit** ripening in November, broadly ovate, truncate or depressed at base, rounded at apex, 3′–5′ long, 2′–3½′ broad, light green when fully grown, becoming yellow and often marked by numerous dark brown blotches when fully ripe, with a thick elongate fibrous torus and light green slightly aromatic insipid flesh of no comestible value; **seeds** ½′ long, slightly obovoid, turgid, rounded at the ends, their margins contracted into a narrow wing formed by the thickening of the outer coat.

A tree, 40°–50° high, with a short trunk often 18′ in diameter above the swell of the thickened tapering base sometimes enlarged into spreading buttresses, stout wide-spreading often contorted branches, slender branchlets brown or yellow during their first season, be-

coming in their second year brown and marked by small scattered wart-like excrescences. **Bark** $\frac{1}{8}'$ thick, dark reddish brown, divided by broad shallow fissures, separating on the surface into numerous small scales. **Wood** light, soft, not strong, light brown streaked with yellow.

Distribution. Florida: Indian River on the east coast, and the shores of the Manatee River on the west coast to the southern Keys; in shallow fresh water ponds, on swampy hummocks, or on the borders of fresh water streams flowing from the everglades; of its largest size on the shores of Bay Biscayne near the Miami River, growing in the shade of larger trees; forming a pure forest of great extent on the swampy borders of Lake Okechobee; on the Bahama Islands and on several of the Antilles.

XVIII. LAURACEÆ.

Aromatic trees and shrubs, with slender terete or angled branchlets, naked or scaly buds, and alternate punctate leaves without stipules. Flowers small, perfect or polygamo-dicecious, yellow or greenish; calyx 6-lobed, the lobes in 2 series, imbricated in the bud; corolla 0; stamens 9 or 12, inserted on the base or near the middle of the calyx in 3 or 4 series of 3's, distinct; anthers 4-celled, superposed in pairs, opening from below upward by persistent lids; ovary 1-celled; stigma discoid or capitate; ovule solitary, suspended from the apex of the cell, anatropous. Fruit a 1-seeded berry; seed without albumen; testa thin and membranaceous, of 2 coats; embryo erect; cotyledons thick and fleshy; radicle superior, turned toward the hilum, included between thick and fleshy cotyledons. The Laurel family with about forty genera, confined mostly to the tropics, is represented in North America by seven genera; of these five are arborescent.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT GENERA.

Leaves entire, persistent; stamens 12 those of the inner row reduced to staminodes.
- Calyx-lobes persistent under the fruit, in our species. **1. Persea.**
- Calyx-lobes deciduous.
  - Flower cymose in axillary or subterminal panicles. **2. Ocotea.**
  - Flowers in axillary many-flowered umbels inclosed before anthesis in an involucre of deciduous scales. **3. Umbellularia.**

Leaves entire or lobed, deciduous; stamens 9 in the American species; flowers in few-flowered drooping racemes. **4. Sassafras.**

Leaves entire, persistent; stamens 9, those of the outer row fertile and united in a column inclosing the pistil; flowers in terminal or axillary cymose panicles. **5. Misanteca.**

1. PERSEA Mill.

Trees, with naked buds. Leaves revolute in the bud, alternate, scattered, penniveined, subcoriaceous, rigid, tomentose or rarely glabrous, persistent. Flowers perfect, vernal, in short axillary or axillary and terminal panicles on slender peduncles from axils of the leaves of the year, pedicellate, their pedicels bibracteolate near the middle, the lateral flowers of the ultimate divisions of the inflorescence in the axils of small deciduous lanceolate acute bracts; calyx campanulate, divided nearly to the base into 6 lobes, those of the outer series shorter than the others, deciduous, or enlarged and persistent under the fruit; stamens about as long as the inner lobes of the calyx; filaments flattened, longer than the anthers, hirsute, those of the third series furnished near the base with 2 nearly sessile orange-colored glands rounded on the back and slightly 2-lobed on the inner face; anthers ovoid, flattened, erect, those of the outer series introrse or subintrorse, those of the third series extrorse or laterally dehiscent, the upper cells rather larger than the lower; staminodes large, sagittate, stipitate, 2-lobed on the inner face, beaded at apex; ovary sessile, subglobose, glabrous, narrowed into a slender simple style gradually enlarged at apex into a

discoid obscurely 2-lobed stigma. Fruit ripening in the autumn, oblong-obovoid to subglobose, more or less fleshy. Seed globose, pendulous, without albumen; testa thin and membranaceous, separable into 2 coats, the outer cartilaginous, grayish brown, the inner gray or nearly white, closely adherent to the thick dark red cotyledons.

About one hundred species of Persea are distinguished. They are distributed in the New World, from the coast region of the southeastern United States and Texas to Brazil and Chili, and occur in the Canary Islands and in tropical and subtropical Asia. *Persea americana* Mill., the Avocado or Alligator Pear, a native of the Antilles and cultivated for its edible fruit in all tropical countries, is now sparingly naturalized in southern Florida. Many species yield hard dark-colored handsome wood valued in cabinet-making.

Persea was the classical name of a tree of the Orient, transferred by Plumier to one of the tropical species of this genus.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Calyx persistent under the fruit (*Tamala Raf.* Persea, sec. Eupersea Benth. *Notaphoebe* sec. *Eriodaphne* Meisn.)

Peduncles short; leaves oblong to oblong-lanceolate, obscurely veined, glabrous; branchlets puberulous. **1. P. Borbonia** (C).

Peduncles elongated; leaves elliptic to lanceolate, conspicuously veined, tomentose on the lower surface; branchlets tomentose. **2. P. palustris Sarg.** (C).

1. Persea Borbonia Spreng. Red Bay.

Leaves oblong to oblong-lanceolate, entire, often slightly contracted into a long point rounded at apex, gradually narrowed below, when they unfold thin, pilose, and tinged with red, and at maturity thick and coriaceous, bright green and lustrous above, pale and glaucous below, 3′–4′ long, $\frac{3}{4}$′–1$\frac{1}{2}$′ wide, with thickened revolute margins, a narrow orange-

Fig. 321

colored midrib, remote obscure primary veins arcuate near the margins, and thin closely reticulated veinlets; unfolding early in the spring, gradually turning yellow a year later, and falling during their second spring and summer; petioles stout, rigid, red-brown, $\frac{1}{2}$′–$\frac{2}{3}$′ in length, flattened and somewhat grooved on the upper side, in falling leaving small circular leaf-scars displaying the end of a single fibro-vascular bundle. **Flowers:** peduncles glabrous, $\frac{1}{2}$′–1′ in length; calyx pale yellow or creamy white, about $\frac{1}{8}$′ long, with thin lobes

ciliate on the margins, the outer broadly ovate, rounded and minutely apiculate, puberulous, about half as long as the oblong-lanceolate acute lobes of the inner series covered within by long pale hairs. **Fruit** $\frac{1}{2}'$ long, dark blue or nearly black, very lustrous; flesh thin and dry, not readily separable from the ovoid slightly pointed **seed.**

A tree, 60°–70° high, with a trunk $2\frac{1}{2}'$–$3'$ in diameter, stout erect branches forming a dense shapely head, thick fleshy yellow roots, and branchlets many-angled, light brown, glabrous or coated with pale or rufous pubescence when they first appear, becoming in their second year terete and dark green; usually much smaller. **Winter-buds** coated with thick rufous tomentum, $\frac{1}{4}'$ long. **Bark** $\frac{1}{2}'$–$\frac{3}{4}'$ thick, dark red, deeply furrowed and irregularly divided into broad flat ridges separating on the surface into small thick appressed scales. **Wood** heavy, hard, very strong, rather brittle, close-grained, bright red, with thin lighter colored sapwood of 4 or 5 layers of annual growth; occasionally used for cabinet-making, the interior finish of houses, and formerly in ship and boatbuilding.

Distribution. Borders of streams and swamps in rich moist soil, or occasionally in dry sandy loam in forests of the Long-leaved Pine; southern Delaware (Cypress swamp near Dogsboro, Sussex County, teste *Nuttall*); coast region from Virginia to the shores of Bay Biscayne and Cape Romano, Florida, along the Gulf coast to the valley of the Brazos River, Texas, and northward through Louisiana to southern Arkansas.

2. Persea palustris Sarg. Swamp Bay.

Persea pubescens Sarg.

Leaves elliptic or lanceolate, entire, often narrowed toward the apex into a long point, gradually narrowed at base, when they unfold dark red, thin and tomentose, at maturity pale green and lustrous above, pale and pubescent and rusty-tomentose on the midrib and

Fig. 322

primary veins below, 4′–6′ long, $\frac{3}{4}'$–$1\frac{1}{2}'$ wide, with thick conspicuous veins and slightly revolute margins; persistent until after the beginning of their second year and then turning yellow and falling gradually; petioles stout, rusty-tomentose, $\frac{1}{2}'$–$\frac{3}{4}'$ in length. **Flowers:** peduncles tomentose, 2′–3′ in length; calyx pale yellow or creamy white, often nearly $\frac{1}{4}'$ long, with thick firm lobes coated on the outer surface with rusty tomentum, those of the outer series broadly ovate, abruptly pointed at apex, pubescent on the inner surface, about half as long as the ovate lanceolate lobes of the inner series slightly thickened at the apex and hairy within. **Fruit** nearly black, $\frac{3}{4}'$ long.

A slender tree, occasionally 30°–40° high, with a trunk rarely exceeding a foot in diame-

ter, and stout branchlets terete or slightly angled while young, coated when they first appear with rusty tomentum reduced in their second season to fine pubescence persistent until the end of their second or third year. **Bark** rarely exceeding $\frac{1}{4}'$ in thickness, dull brown, irregularly divided by shallow fissures, the surface separating into thick appressed scales. **Wood** heavy, soft, strong, close-grained, orange color streaked with brown, with thick light brown or gray sapwood of 36–40 layers of annual growth.

Distribution. Pine-barren swamps, often almost to the exclusion of other plants, usually in the neighborhood of the coast from North Carolina to the valley of the Caloosahatchee River and the Everglades Keys, Florida, Alabama and Mississippi; extending inland to the neighborhood of Wilmington, North Carolina, Aiken, South Carolina, western Georgia (Meriwether County), the interior of the Florida peninsula and to Clay, Autauga, Chilton and Tuscaloosa Counties, Alabama (*R. M. Harper*); very common in Pine barrens of eastern Louisiana (*R. S. Cocks*).

2. OCOTEA Aubl.

Leaves scattered, alternate or rarely subopposite, penniveined, coriaceous, rigid, glabrous or more or less covered with pubescence. Flowers glabrous or tomentose on slender bibracteolate pedicels from the axils of lanceolate acute minute bracts, in cymose clusters in axillary or subterminal stalked panicles; calyx-tube campanulate, the 6 lobes of the limb nearly equal, deciduous; stamens of the inner series reduced to linear staminodes, with minute abortive anthers; filaments inserted on the tube of the calyx, those of the outer series opposite its exterior lobes, shorter or sometimes rather longer than the anthers, glabrous or hirsute, furnished in the third series near the base with two conspicuous globose stalked yellow glands; anthers oblong, flattened, 4-celled, introrse in the 2 outer series, extrorse, subextrorse, or very rarely introrse in the third series, in the pistillate flower rudimentary and sterile; ovary ovoid, glabrous, more or less immersed in the tube of the calyx, gradually narrowed into a short erect style dilated at apex into a capitate obscurely lobed stigma; in the staminate flower linear-lanceolate, effete or minute, sometimes 0; raphe ventral; micropyle superior. Fruit nearly inclosed while young in the thickened tube of the calyx, exserted at maturity, surrounded at base by the cup-like truncate or slightly lobed calyx-tube; pericarp thin and fleshy. Seed ovoid, pendulous; testa thin, membranaceous.

Ocotea with nearly two hundred species is confined principally to the tropical region of the New World from southern Florida to Brazil and Peru, with Old World representatives in the Canary Islands, South Africa, and the Mascarene Islands. One species grows naturally in Florida.

Ocotea produces hard, strong, durable, beautifully colored wood often employed in cabinet-making.

The name is derived from the native name of one of the species of Guiana.

1. Ocotea Catesbyana Sarg.

Leaves oblong-lanceolate, entire, slightly contracted above into a long point rounded at apex, when they unfold thin, membranaceous, light green tinged with red, and sometimes puberulous on the lower surface, at maturity thick and coriaceous, dark green and lustrous above, pale below, 3′–6′ long, 1′–2′ wide, with thickened slightly revolute margins, a broad stout midrib, slender remote primary veins arcuate and united near the margins and connected by coarsely reticulate conspicuous veinlets; petioles broad, flat, $\frac{1}{3}'$–$\frac{1}{2}'$ in length. **Flowers** perfect, appearing in early summer in elongated panicles, their peduncles slender, glabrous, light red, solitary or 2 or 3 together from the axils of the leaves of the year or from those of the previous year, and 3′–4′ long; calyx nearly $\frac{1}{4}'$ across when expanded, puberulous on the outer surface, hoary pubescent on the inner surface and on the margins of the lobes, about twice as long as the stamens; filaments of the 2 outer series slightly hirsute at the base and shorter than their introrse anthers; filaments of the third series as long or longer than their extrorse anthers. **Fruit** ripening in the autumn, ovoid

or subglobose, $\frac{2}{3}'$ long, lustrous, dark blue or nearly black, the thickened cup-like tube of the calyx truncate or obscurely lobed and bright red like the thickened pedicels; flesh thin and dry; **seed** with a thin brittle red-brown coat, the inner layer lustrous on the inner surface and marked by broad light-colored veins radiating from the small hilum; embryo $\frac{1}{3}'$ long, light red-brown.

A tree, 20°–30° high, with a trunk rarely exceeding 18′ in diameter, slender spreading branches forming a narrow round-topped head, and thin terete branchlets glabrous and dark reddish brown when they first appear, soon becoming lighter colored, and in their second year light brown or gray tinged with red and often marked by minute pale lenticels, and in their second or third year by small semiorbicular leaf-scars, displaying a single central

Fig. 323

fibro-vascular bundle-scar. **Bark** about $\frac{1}{8}'$ thick, dark reddish brown, and roughened on the otherwise smooth surface by numerous small excrescences. **Wood** heavy, hard, close-grained, rich dark brown, with thick bright yellow sapwood of 20–30 layers of annual growth.

Distribution. Shores and islands of Florida south of Cape Canaveral on the east coast and of Cape Romano on the west coast; comparatively common except on some of the western keys, and most abundant and of its largest size in the rich wooded hummocks adjacent to Bay Biscayne; in the Bahamas.

3. UMBELLULARIA Nutt.

A pungent aromatic tree, with dark brown scaly bark, slender terete branchlets marked in their second and third years by small semicircular or nearly triangular elevated leaf-scars displaying a horizontal row of minute fibro-vascular bundle-scars, naked buds, and thick fleshy brown roots. Leaves alternate, involute in the bud, lanceolate or ovate-lanceolate, acute or rounded at the narrow apex, cuneate or somewhat rounded at base, entire with thickened slightly revolute margins, petiolate, coated when they appear on the lower surface with pale soft pubescence and puberulous on the upper surface, at maturity thick and coriaceous, dark green and lustrous above, dull and paler below, with a slender light yellow midrib, and remote, obscure, arcuate veins more or less united near the margins, and connected by conspicuous reticulate veinlets. Flowers perfect in axillary stalked many-flowered umbels, inclosed in the bud by an involucre of 5 or 6 imbricated broadly ovate or obovate pointed concave yellow caducous scales, the latest umbels subsessile at the base of terminal leaf-buds; pedicels slender, puberulous, without bractlets, from the axils of obovate mem-

branaceous puberulous deciduous bracts decreasing in size from the outer to the inner; calyx divided almost to the base into 6 nearly equal broadly obovate rounded pale yellow lobes spreading and reflexed after anthesis; stamens inserted on the short slightly thickened tube of the calyx; filaments flat, glabrous, pale yellow, rather shorter than the anthers, those of the third series furnished near the base with 2 conspicuous stipitate orange-colored orbicular flattened glands; anthers oblong, flattened, light yellow, those of the first and second series introrse, those of the third series extrorse; stamens of the fourth series reduced to minute ovate acute yellow staminodes; ovary sessile, ovoid, often more or less gibbous, glabrous, abruptly contracted into a stout columnar style rather shorter than the lobes of the calyx and crowned by a simple capitate discoid stigma. Fruit ovoid, surrounded at base by the enlarged and thickened truncate or lobed tube of the calyx, yellow-green sometimes more or less tinged with purple; pericarp thin and fleshy. Seed ovoid, light brown; testa separable into 2 coats, the outer thick, hard, and woody, the inner thin and papery, closely investing the embryo, chestnut-brown and lustrous on the inner surface.

Umbellularia consists of a single species.

The generic name, a diminutive of *umbella*, relates to the character of the inflorescence.

1. Umbellularia californica Nutt. California Laurel. Spice-tree.

Leaves 2′–5′ long, ½′–1½′ wide, unfolding in winter or early in the spring and continuing to appear as the branches lengthen until late in the autumn; beginning to fade during the summer, turning to a beautiful yellow or orange color and falling one by one during their

Fig. 324

second season, or often remaining on the branches until the sixth year; petioles ½′–½′ in length. **Flowers** appearing in January before the unfolding of the young leaves, the umbels on peduncles sometimes 1′ in length. **Fruit** about 1′ long, in clusters of 2 or 3, on elongated thickened pedicels, persistent on the branch after the fruit ripens and falls late in the autumn; **seeds** germinating soon after they reach the ground, the fruit remaining below the surface of the soil and attached to the young plant until midsummer.

A tree, usually 20°–75°, occasionally 100°–175° high, with a trunk 3°–6° in diameter, sometimes tall and straight but usually divided near the ground into several large diverging stems, stout spreading or rarely pendulous (var. *pendula* Redh.) branches forming a broad round-topped head, and branchlets light green and coated with soft pale pubescence when they first appear, soon becoming glabrous and yellow-green, and in their second and third years light brown tinged with red; at high altitudes, and in southern California much smaller; often reduced to a large or small shrub, or on bluffs facing the ocean to broad mats

of prostrate stems. **Bark** $\frac{3}{4}'$–1′ thick, dark brown tinged with red, separating on the surface into thin appressed scales. **Wood** heavy, hard, strong, close-grained, light rich brown, with thick lighter colored sapwood of 30–40 layers of annual growth; the most valuable wood produced in the forests of Pacific North America for the interior finish of houses and for furniture. The leaves yield by distillation a pungent volatile oil, and from the fruit a fat containing umbellulic acid has been obtained.

Distribution. Valley of Coos River, Oregon, southward through the California coast ranges and along the high western slopes of the Sierra Nevada to the southern slopes of the San Bernardino Mountains up to altitudes of 2500°; usually near the banks of watercourses and sometimes on low hills; common where it can obtain an abundant supply of water; most abundant and of its largest size in the rich valleys of southwestern Oregon, forming with the Broad-leaved Maple a considerable part of the forest growth.

4. SASSAFRAS Nees. Sassafras.

Pseudosassafras H. Lec.

Aromatic trees, with thick deeply furrowed dark red-brown bark, scaly buds, slender light green lustrous brittle branchlets containing a thick white mucilaginous pith and marked by small semiorbicular elevated leaf-scars displaying a single horizontal row of minute fibro-vascular bundle-scars, and stout spongy stoloniferous roots covered by thick yellow bark. Flower-bearing buds terminal, ovoid, acute, with 9 or 10 imbricated scales increasing in size from without inward, the 3 outer scales ovate, rounded, often apiculate at apex, keeled and thickened on the back, pale yellow-green below, dull yellow-brown above the middle, loosely imbricated, slightly or not at all accrescent, deciduous at the opening of the bud, much smaller than the thin accrescent light yellow-green scales of the next rows turning dull red before falling, and obovate, rounded at apex, cuneate below, concave, coated on the outer surface with soft silky pubescence, glabrous or lustrous on the inner surface, reflexed, $\frac{3}{4}'$ long, nearly $\frac{1}{2}'$ broad, tardily deciduous, the 2 inner scales foliaceous, lanceolate, acute, light green, coated on the outer surface with delicate pale hairs, glabrous on the inner surface, infolding the leaves; sterile and axillary buds much smaller. Leaves involute in the bud, ovate or obovate, entire or often 1–3-lobed at apex, the lobes broadly ovate, acute, divided by deep broad sinuses, gradually narrowed at base into elongated slender petioles, feather-veined, with alternate veins arcuate and united or running to the points of the lobes, the lowest parallel with the margins, conspicuously reticulate-venulose, mucilaginous, deciduous. Flowers opening in early spring with the first unfolding of the leaves, the males and females usually on different individuals, in lax drooping few-flowered racemes in the axils of large obovate bud-scales, their pedicels slender, rarely forked and 2-flowered, without bracts, pilose, from the axils of linear acute scarious hairy deciduous bracts, or that of the terminal flower often without a bract; calyx pale yellow-green, divided nearly to the base into narrow obovate concave lobes spreading or reflexed after anthesis, glabrous or pubescent on the inner surface, those of the inner row a little larger than the others; stamens in the American species 9, in the Asiatic 12 with those of the inner series reduced to staminodes, inserted on the somewhat thickened margin of the shallow concave calyx-tube, those of the outer series opposite its outer lobes; filaments flattened, elongated, light yellow, those of the inner series furnished at base with 2 conspicuous orange-colored stipitate glands rounded on the back, obscurely lobed on the inner face, in the Asiatic species alternating with 3 staminodes; anthers introrse, oblong, flattened, truncate or emarginate at apex, 4-celled, 2-celled in the Formosan species, orange-colored, in the female flower reduced to flattened ovate pointed or slightly 2-lobed dark orange-colored stipitate staminodes, 6 in 2 rows in the American species and 12 similar to the stamens and staminodes of the staminate flower in the Asiatic species; or occasionally fertile and similar to or a little smaller than those of the staminate flower; ovary ovoid, light green, glabrous, nearly sessile in the short tube of the calyx, narrowed into an elongated simple style gradually enlarged above into a capitate oblique obscurely lobed stigma; in the staminate flower 0 in the American species,

present, usually abortive, rarely fertile in the Asiatic species. Fruit an oblong dark blue or black lustrous berry surrounded at base by the enlarged and thickened obscurely 6-lobed or truncate scarlet or orange-red limb of the calyx, raised on a much elongated scarlet stalk thickened above the middle; pericarp thin and fleshy. Seed oblong, pointed, light brown; testa thin, membranaceous, barely separable into 2 coats, the inner coat much thinner than the outer, dark chestnut-brown, and lustrous.

Sassafras is confined to temperate eastern North America, central China and to Formosa where *Sassafras tzumu* Hemsl. and *S. randaiense* Rehd. occur.

Sassafras was first used as a popular name for this tree by the French in Florida.

11. Sassafras officinale Nees & Ebermaier.

Sassafras Sassafras Karst.

Leaves 4′–6′ long, 2′–4′ wide, densely pubescent when they first appear, pubescent or puberulous below at maturity especially on the midrib and veins; turning in the autumn delicate shades of yellow or orange more or less tinged with red; petioles $\frac{3}{4}$′–$1\frac{1}{2}$′ in length. **Flowers** $\frac{1}{3}$′ long when fully expanded glabrous on the inner surface of the perianth, in

Fig. 325

racemes about 2′ in length, stamens 9. **Fruit** ripening in September and October, blue, $\frac{1}{3}$′ long, on stalks $1\frac{1}{2}$′–2′ in length, separating when ripe from the thick scarlet calyx-lobes persistent with the stalks of the fruit on the branches until the beginning of winter.

A tree, occasionally 80°–90° high, with a trunk nearly 6° in diameter, short stout more or less contorted branches spreading almost at right angles and forming a narrow usually flat-topped head, and slender branchlets light yellow-green and coated when they first appear with pale pubescence, becoming glabrous, bright green and lustrous, gradually turning reddish brown at the end of two or three years; frequently not more than 40°–50° tall; at the north and in Florida generally smaller and often shrubby. **Winter-buds** $\frac{1}{4}$′–$\frac{3}{8}$′ long. **Bark** of young stems and branches thin, reddish brown divided by shallow fissures, becoming on old trunks sometimes $1\frac{1}{2}$′ thick, dark red-brown, and deeply and irregularly divided into broad flat ridges separating on the surface into thick appressed scales. **Wood** soft, weak, brittle, coarse-grained, very durable in the soil, aromatic, dull orange-brown, with thin light yellow sapwood of 7 or 8 layers of annual growth; largely used for fence-posts and rails, in the construction of light boats, ox-yokes, and in cooperage. The roots and especially their bark are a mild aromatic stimulant, and oil of sassafras, used to perfume soap and other articles, is distilled from them. Gumbo filet, a powder prepared from the leaves by

the Choctaw Indians of Louisiana, gives flavor and consistency to gumbo soup. Passing into the var. *albidum* Blake, with glabrous or nearly glabrous young leaves, glabrous often glaucous young branchlets, and lighter colored less valuable wood; uplands of western New England to the mountains of western North Carolina and eastern Tennessee.

Distribution. Usually in rich sandy well-drained soil, southern Maine and eastern Massachusetts, through southern Vermont to southern Ontario, central Michigan, and southeastern Iowa to eastern Kansas and Oklahoma, and southward to central Florida (Orange County) and the valley of the Brazos River, Texas; ascending on the southern Appalachian Mountains to altitudes of 4000°; in the south Atlantic and Gulf states often taking possession of abandoned fields.

Occasionally cultivated in the eastern states as an ornamental tree.

5. MISANTECA Cham. & Schl.

Trees with terete branchlets. Leaves coriaceous, persistent. Flowers perfect, minute, on slender pedicels, in terminal or axillary cymose panicles; peduncles and pedicels from the axils of acuminate caducous bracts and bractlets; perianth fleshy, ovoid or obovoid, 6-toothed; stamens 9, inserted near the middle of the perianth, those of the outer rank united into a fleshy column, furnished at base with three pairs of glands, inclosing the pistil and slightly longer than the perianth, those of the inner ranks, sterile, short or obsolete; anthers extrorse, 2-celled, the cells united; ovary gradually narrowed into a thick style as long as the staminal tube; stigma capitate. Fruit baccate, olive-shaped, surrounded at base by the enlarged ligneous capsular perianth of the flower much thickened on the margin; pericarp thin and fleshy; endocarp thin, crustaceous; seed filling the cavity of the fruit; testa thin, crustaceous; hilum minute, apical; cotyledons plano-convex, fleshy; radicle superior, minute.

Of the three species of the genus now known one occurs in southern Florida and Cuba, and the others in tropical Mexico.

The name of the genus is derived from the name of the tree, Palo Misanteca at Misantha, near the coast of the state of Vera Cruz where the type species was discovered.

1. Misanteca triandra Mez.

Leaves elliptic-lanceolate, ovate or broad-elliptic, entire, abruptly long-pointed and acuminate at apex, gradually narrowed and acuminate at base, deeply tinged with red and

Fig. 326

villose on the under side of the midrib when they unfold, soon glabrous, and at maturity dark green and lustrous above, pale below, 3′–4′ long and 1½′–2′ wide, with slightly undulate margins, a prominent midrib, slender primary veins, and reticulate veinlets conspicuous on the lower surface; petioles stout, narrow wing-margined at apex, pubescent when they first appear, soon glabrous, ⅓′–½′ in length. **Flowers** glabrous or puberulous, purplish, about ½′ long, in 3–5-flowered cymes on slender peduncles, in pubescent panicles shorter than the leaves; tube of the perianth funnel-form, the lobes equal, triangular, acute; column of stamens pilose; ovary glabrous. **Fruit** in few-fruited clusters on much elongated and thickened peduncles, ellipsoidal or slightly ovoid, acute, dark blue, ⅘′ long and ⅗′ thick; cupule light red, thickened and verrucose, acute at base, the margin reflexed, thin and entire on the inner edge, thick and crenulate on the outer edge; seed ellipsoidal, pointed at apex, rounded at base, light brown, slightly ridged when dry.

A tree in Florida 40°–50° high, with a tall trunk 15′–20′ in diameter, small spreading and pendent branches forming a broad round-topped head, and slender red branchlets pubescent when they first appear, soon becoming glabrous, and marked by numerous large pale lenticels.

Rich hummocks between Miami and Homestead, Dade County, Florida; in Cuba and Jamaica.

XIX. CAPPARIDACEÆ.

Annual or perennial herbs, trees, or shrubs, with acrid often pungent juices, alternate or rarely opposite leaves, regular or irregular usually perfect flowers in terminal cymes or racemes or solitary, numerous ovules inserted in two rows on each of the two placentas, capsular or baccate 1-celled fruit, and seeds without albumen. A family of thirty-four genera, mostly confined to the warmer parts of the world and widely distributed in the two hemispheres. Of the seven genera which occur in North America only one has an arborescent representative.

1. CAPPARIS L.

Trees, with naked buds. Leaves conduplicate in the bud, entire, feather-veined, coriaceous, persistent, without stipules. Flowers regular, in terminal cymes; sepals 4, valvate in the bud, glandular on the inner surface; petals 4, inserted on the base of the short receptacle; stamens numerous, inserted on the receptacle, their filaments free, elongated, much longer than the introrse 2-celled anthers opening longitudinally; ovary long-stalked, 2-celled, with 2 parietal placentas; stigmas sessile, orbicular; ovules campylotropous. Fruit baccate, siliquiform (in the North American species) separating into 3 or 4 valves. Seeds reniform, numerous, surrounded by pulp; seed-coat coriaceous; embryo convolute; cotyledons foliaceous, fleshy.

Capparis, with more than one hundred species, mostly tropical, is found in the two hemispheres, the largest number of species occurring in Central and South America. Two of the West Indian species reach the shores of southern Florida, the most northern station of the genus in America; of these one is arborescent.

Capparis, from *κάππαρις*, the classical name of *Capparis spinosa* L., is derived from the Persian *kabor*, capers, the dried flower-buds of that species.

1. Capparis jamaicensis Jacq.

Leaves oblong-lanceolate, rounded and emarginate at apex, slightly revolute, coriaceous, light yellow-green, smooth and lustrous on the upper surface, covered on the lower by minute ferrugineous scales, 2′–3′ long, 1′–1½′ wide, with a prominent midrib and inconspicuous primary veins; petioles stout covered at first with ferrugineous scales often becoming nearly glabrous, ⅓′–½′ in length. **Flowers** 1¼′ in diameter, opening in Florida in April and May from obtuse or acute, 4-angled buds; sepals ovate, acute, lepidote on the outer surface, furnished on the inner with a small ovate gland, recurved when the flower is

fully expanded, and about half the size of the round white petals turning purple in fading; stamens 20–30, with purple filaments villose toward the base, $1\frac{1}{2}'$–$2'$ long; anthers yellow; ovary raised on a slender stipe about $1\frac{1}{2}'$ in length. **Fruit** $9'$–$12'$ long, terete, sometimes slightly torulose, pubescent-lepidote, the long stalk appearing jointed by the enlargement of the pedicel and torus below the insertion of the stipe; **seed** light brown, $1\frac{1}{4}'$ long.

Fig. 327

A small slender shrubby tree, 18°–20° high, with a trunk sometimes $5'$–$6'$ in diameter, and thin angled branchlets dark gray, smooth or slightly rugose, and covered with minute ferrugineous scales. **Bark** rarely more than $\frac{1}{5}'$ thick, slightly fissured, the dark red-brown surface broken into small irregularly shaped divisions. **Wood** heavy, hard, close-grained, yellow faintly tinged with red, with lighter colored sapwood of about 15 layers of annual growth.

Distribution. Coast of Florida; Cape Canaveral and Cape Sable to the southern keys; generally distributed, but nowhere abundant; common on several of the Antilles.

XX. HAMAMELIDACEÆ.

Trees or shrubs, with watery juice, slender terete branchlets, naked or scaly buds, and fibrous roots. Leaves alternate, petiolate, stipulate, deciduous. Flowers perfect or unisexual; calyx 4-parted or 0; petals 4 or 0; stamens 4–8; anthers attached at the base, introrse, 2-celled; ovary inserted in the bottom of the receptacle, 2-celled; ovules 1 or many, anatropous, suspended from an axile placenta; micropyle superior; raphe ventral. Fruit a woody capsule opening at the summit. Seed usually 1; embryo surrounded by fleshy albumen; cotyledons oblong, flat, longer than the terete radicle turned toward the hilum. The Witch Hazel family with twenty genera is confined to eastern North America, southwestern, southern, and eastern Asia, the Malay Archipelago, Madagascar, and South Africa. Of the three North American genera two are arborescent.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT GENERA.

Flowers usually unisexual, capitate, without petals, limb of the calyx short or nearly obsolete; capsules consolidated by their base into a globose head; seed with a terminal wing; leaves palmately lobed. **1. Liquidambar.**

Flowers usually perfect, with calyx and corolla; capsules not consolidated into a head; seed without a wing. **2. Hamamelis.**

1. LIQUIDAMBAR L.

Trees, with balsamic juices, scaly bark, terete often winged branchlets, scaly buds, and fibrous roots. Leaves plicate in the bud, alternate, palmately lobed, glandular-serrate, long-petiolate; stipules lanceolate, acute, caducous. Flowers monœcious or rarely perfect in capitate heads surrounded by an involucre of 4 deciduous bracts, the staminate in terminal racemes, the pistillate in solitary long-stalked heads from the axils of upper leaves; staminate flowers without a calyx and corolla; stamens indefinite, interspersed with minute scales; filaments filiform, shorter than the oblong obcordate anthers opening longitudinally; pistillate flowers surrounded by long-awned scales, the whole confluent into a globular head; calyx obconic, its limb short or nearly obsolete; stamens usually 4, inserted on the summit of the calyx; anthers minute, usually rudimentary or abortive, rarely fertile; ovary partly inferior, of 2 united carpels terminating in elongated subulate recurved persistent styles stigmatic on the inner face; ovules numerous. Capsules armed with the hardened incurved elongated styles free above, septicidally dehiscent, consolidated by their base into a globose head; pericarp thick and woody; endocarp thin, corneous, lustrous on the inner surface. Seeds usually solitary or 2 by the abortion of many ovules, compressed, angulate; seed-coat opaque, crustaceous, produced into a short membranaceous obovate terminal wing rounded at the oblique apex.

Liquidambar with about four species is confined to the eastern United States, southern and central Mexico, Central America, southwestern Asia, middle and southeastern China, and Formosa. Liquid storax, an opaque grayish brown resin, is derived from *Liquidambar orientalis* Mill., a native of Asia Minor.

Liquidambar from *liquidus* and *ambar* in allusion to the fragrant juices.

1. Liquidambar Styraciflua L. Sweet Gum. Bilsted.

Leaves generally round in outline, truncate or slightly heart-shaped at base, deeply 5–7-lobed, with acutely pointed divisions finely serrate with rounded appressed teeth,

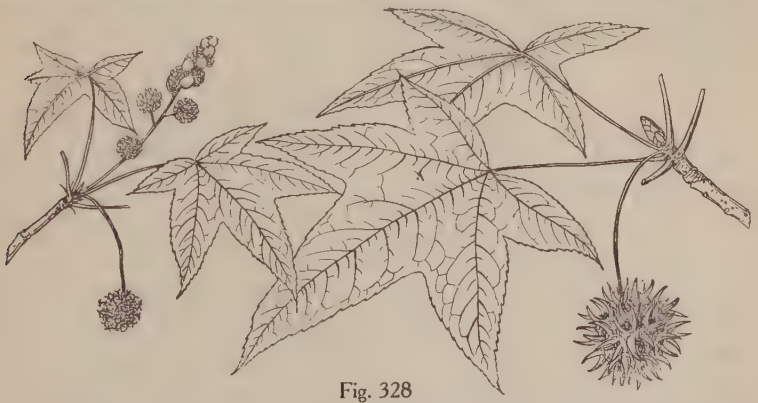

Fig. 328

when they unfold pilose on the lower surface, soon becoming glabrous with the exception of large tufts of pale rufous hairs in the axils of the principal veins, at maturity thin, bright green, smooth and lustrous, 6′–7′ across, with broad primary veins and finely reticulate veinlets; exhaling when bruised a pleasant resinous fragrance; in the autumn turning deep crimson; petioles slender, covered at first near the base with rufous caducous hairs, and 5′–6′ in length; stipules entire, glabrous, $\frac{1}{3}$′–$\frac{1}{2}$′ long. Flowers: staminate in terminal racemes 2′–3′ long covered with rufous hairs, in heads stalked toward the base of the raceme and nearly sessile above, $\frac{1}{4}$′ in diameter, and surrounded by ovate acute deciduous hairy bracts much larger than the lanceolate acute bracts of the female inflorescence $\frac{1}{2}$′

across and conspicuous from the broad stigmatic surfaces of the recurved and contorted styles. **Fruit** 1′–1½′ in diameter, persistent during the winter, the carpels opening in the autumn; **seed** ½′ long and rather longer than its wing, with a light brown coat conspicuously marked by oblong resin-ducts.

A tree, 80°–140° high, with a straight trunk 4°–5° in diameter, slender branches forming while the tree is young a pyramidal head, and in old age a comparatively small oblong crown, and slender branchlets containing a large pith, slightly many-angled, covered when they first appear with caducous rufous hairs, light orange color to reddish brown in their first winter, marked by occasional minute dark lenticels and by large arcuate leaf-scars showing the ends of 3 conspicuous fibro-vascular bundles, developing in their second season corky wings appearing on the upper side of lateral branches in 3 or 4 parallel ranks and irregularly on all sides of vertical branches, and increasing in width and thickness for many years, sometimes becoming 2′–3′ broad and 1′ thick. **Winter-buds** acute, ¼′ long, and covered by ovate acute minutely apiculate orange-brown scales rounded on the back, those of the inner rows accrescent, tipped with red, and about 1′ long at maturity. **Wood** heavy, hard, straight, close-grained, not strong, bright brown tinged with red, with thin almost white sapwood of 60–70 layers of annual growth; used for the outside and inside finish of houses, in cabinet-making, for street pavement, wooden dishes, and fruit boxes.

Distribution. Fairfield County, Connecticut, and in the neighborhood of the coast to southeastern Pennsylvania, southward to Cape Canaveral and the shores of Tampa Bay, Florida, and westward through southern Ohio, Indiana and Illinois to southeastern Missouri, and through Arkansas to eastern Oklahoma and the valley of the Trinity River, Texas; reappearing on the mountains of central and southern Mexico and on the highlands of Guatemala; in the maritime region of the south Atlantic and Gulf states and in the basin of the lower Mississippi River one of the common trees of the forest, covering rich river bottom-lands usually inundated every year; in the northern and middle states on the borders of swamps and low wet swales; at the north rarely more than 60°–70° tall, with a trunk usually not more than 2° in diameter.

Unsurpassed in the brilliancy of the autumnal colors of the leaves; and often planted as an ornamental tree in the eastern states.

2. HAMAMELIS L. Witch Hazel.

Trees or shrubs, with scaly bark, terete zigzag branchlets, naked buds, and fibrous roots. Leaves involute in the bud, more or less unsymmetrical at base, crenately toothed or lobed, the primary veins conspicuous; stipules acute, infolding the bud, deciduous. Flowers perfect, autumnal or hiemal, in 3 or rarely 4-flowered terminal clusters, from buds appearing in summer, on short recurved peduncles from the axils of leaves of the year, furnished near the middle with 2 acute deciduous bractlets, covered like their acute bracts and bractlets with dark ferrugineous pubescence, each flower surrounded by 2 or 3 ovate acute bracts, the outer slightly united at base into a 3-lobed involucre; calyx 4-parted pale pubescent on the outer surface, orange-brown, yellow or red on the inner surface, persistent on the base of the ovary, the lobes reflexed; petals bright yellow, inserted on the margin of the cup-shaped receptacle, alternate with the sepals, strap-shaped, falling with the stamens when the ovules are fertilized; stamens 8, inserted in 2 rows on the margin of the receptacle, the 4 opposite the lobes of the calyx fertile, the others reduced to minute strap-shaped scales; filaments free, shorter than the calyx, prolonged into a thickened pointed connective; anthers ellipsoid, opening laterally from without by persistent valves; ovary of 2 carpels, free at apex, inserted in the bottom of the receptacle, partly superior, remaining during the winter without enlarging and surrounded and protected by the calyx; styles subulate, spreading, stigmatic at apex, persistent; ovule solitary. Fruit ripening in the autumn, usually 2 from each flower-cluster, capsular, 2-beaked at apex, surrounded for one-third or one-half its length by the enlarged persistent calyx bearing at the base the blackened remnants of the floral bracts, the thick and woody outer layer splitting from

above loculicidally before the opening of the thin crustaceous inner layer. Seed oblong, acute, suspended; testa crustaceous, chestnut brown, shining; forcibly discharged when ripe by the contraction of the edges of the valves of the bony endocarp; embryo surrounded by thick fleshy albumen; cotyledons foliaceous; hilum oblong, depressed.

Hamamelis is confined to eastern North America and eastern Asia, with three American and two or three Asiatic species; of the American species two are sometimes small trees, and the third *H. vernalis* Sarg. is a shrub of southern Missouri, western Arkansas, and eastern Oklahoma.

The name is from ἁμα, at the same time with, and μηλίς an Apple-tree, and was applied by the ancients to the Medlar or some similar tree.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT SPECIES.

Leaves smooth, conspicuously unsymmetrical at base; flowers autumnal.
1. **H. virginiana** (A, C).

Leaves roughened by persistent tubercles, slightly unsymmetrical at base; flowers hiemal.
2. **H. macrophylla** (C).

1. Hamamelis virginiana L.

Leaves obovate, acuminate, long-pointed or sometimes rounded at apex, very unequal at base, the lower side rounded or subcordate, the upper usually cuneate and smaller, irregularly and coarsely crenately lobed above the middle, entire or dentate below, when

Fig. 329

they unfold coated, especially on the lower surface of the midrib and veins and on the petioles and stipules with stellate ferrugineous pubescence, at maturity membranaceous, dull dark green and glabrous or pilose above, lighter colored and lustrous below, and pubescent or puberulous on the stout midrib and 6 or 7 pairs of primary veins, 4′–6′ long, 2′–2½′ wide; turning delicate yellow in the autumn; petioles slender, pubescent early in the season, becoming glabrous ⅓′–1′ in length; stipules lanceolate, acute, coriaceous, ⅓′–½′ long. **Flowers** opening from the middle of September to the middle of November; calyx orange-brown on the inner surface; petals bright yellow; ½′–⅔′ long. **Fruit** ripening when the flowers of the season are expanding, ½′ long, pubescent, dull orange-brown and surrounded for half its length by the large persistent calyx; **seed** ¼′ long.

A tree, occasionally 20°–25° high, with a short trunk 12′–14′ in diameter, spreading branches forming a broad open head, and slender flexible branchlets coated at first with scurfy rusty stellate hairs, gradually disappearing during the summer, and in their first winter glabrous or slightly puberulous, light orange-brown and marked by small white dots, becoming in their second year dark or reddish brown; usually a stout shrub sending

up from the ground numerous rigid diverging stems 5°–20° tall. **Winter-buds** acute, slightly falcate, light orange-brown, covered with short fine pubescence, $\frac{1}{4}'$–$\frac{1}{2}'$ long. **Bark** $\frac{1}{8}'$ thick, light brown, generally smooth but broken into minute thin appressed scales disclosing in falling the dark reddish purple inner bark. **Wood** heavy, hard, very close-grained, light brown tinged with red, with thick nearly white sapwood of 30–40 layers of annual growth. The bark and leaves are slightly astringent and although not known to possess essential properties are largely used in the form of fluid extracts and decoctions and in homœopathic practice, Pond's Extract being made by distilling the bark in diluted alcohol.

Distribution. Nova Scotia, New Brunswick, and the valley of the St. Lawrence River to southern Ontario, southern Wisconsin, southeastern Minnesota and northeastern Iowa, and southward to central Georgia and southern Arkansas, growing usually on the borders of the forest in low rich soil or on the rocky banks of streams; of its largest size and probably only arborescent on the slopes of the high Alleghany Mountains in North and South Carolina and Tennessee.

Occasionally cultivated as an ornamental plant in the northern states, and in western and northern Europe.

2. Hamamelis macrophylla Pursh.

Leaves short-obovate or occasionally broad-elliptic, rounded, acute or rarely acuminate at apex, cuneate, rounded or cordate at the narrow slightly unsymmetrical base, crenate-lobulate above the middle with small rounded lobes, covered with short stellate hairs more

Fig. 330

abundant on the upper than on the lower surface, and at maturity dark green above, paler below, and roughened by the persistent tubercle-like bases of the stellate hairs, 3′–5′ long, 2′–3′ wide, with a slender midrib and five or six pairs of primary veins; petioles slender, pubescent, $\frac{1}{2}'$–$\frac{3}{4}'$ in length; stipules lanceolate, acuminate, scarious, hoary-pubescent, $\frac{1}{5}'$–$\frac{1}{6}'$ long. **Flowers** opening in December, January and February; calyx yellow on the inner surface; petals light yellow, $\frac{1}{2}'$ long and less than $\frac{1}{24}'$ wide. **Fruit** ripening in the autumn, about $\frac{3}{4}'$ in length; **seed** dark chestnut-brown or nearly black.

A tree, often 30°–45° high, producing stoloniferous shoots round the tall trunk often 1° in diameter, erect and spreading branches, and branchlets rusty or hoary-tomentose during their first year, becoming glabrous or nearly glabrous and grayish brown in their second season; often a shrub. **Winter-buds** rusty-tomentose, about $\frac{1}{3}'$ in length.

Distribution. Rich soil, by streams or along the borders of the forest; valley of the lower Savannah River, near Savannah, Chatham County, and along the Withlacoochee River, Lowndes County, Georgia, to central and western Florida; through Alabama; in

southern and central Mississippi, and through Louisiana to eastern Texas (Beaumont, Jefferson County, and Fletcher, Hardin County), and southern Arkansas; generally distributed and most abundant in Louisiana; probably of its largest size on the bluffs of the Alabama River in Dallas County, Alabama.

XXI. PLATANACEÆ.

Trees, with watery juice, thick deeply furrowed scaly bark exfoliating from the branches and young trunks in large thin plates, terete zigzag pithy branchlets prolonged by an upper axillary bud, and fibrous roots. Winter-buds axillary, conic, large, smooth, and lustrous, nearly surrounded at base by the narrow leaf-scars displaying a row of conspicuous dark fibro-vascular bundle-scars, covered by 3 deciduous scales, the 2 inner accrescent, strap-shaped, rounded at apex at maturity, marking in falling the base of the branchlet with narrow ring-like scars, the outer scale surrounding the bud and splitting longitudinally with its expansion, the second light green, covered by a gummy fragrant secretion and usually inclosing a bud in its axil, the third coated with long rufous hairs. Leaves longitudinally plicate in vernation, alternate, broadly ovate, cordate, truncate, or cuneate and decurrent on the petiole at base, more or less acutely 3–7-lobed, and occasionally furnished with a more or less enlarged basal lobe, the lobes entire, dentate with minute remote callous teeth, or coarsely sinuate-toothed, penniveined, the veins arcuate and united near the margins and connected by inconspicuous reticulate veinlets, clothed while young like the petioles, stipules, and young branchlets with caducous stellate sharp-pointed branching hairs, pale on the lower and rufous on the upper surface, long-petiolate; turning brown and withering in the autumn before falling; petioles abruptly enlarged at base and inclosing the buds; stipules membranaceous, laterally united below into a short tube surrounding the branchlet above the insertion of their leaf, acute, more or less free above, dentate or entire, thin and scarious on flowering shoots, broad and leaf-like on vigorous sterile branchlets, caducous, marking the branchlet in falling with narrow ring-like scars. Flowers minute, appearing with the unfolding of the leaves in dense unisexual pedunculate solitary or spicate heads, the staminate and pistillate heads on separate peduncles or rarely united on the same peduncle; staminate heads dark red on axillary peduncles; pistillate heads light green tinged with red, on long terminal peduncles, the lateral heads in the spicate clusters sessile and embracing at maturity the peduncle, usually persistent on the branches during the winter; calyx of the staminate flower divided into 3–6 minute scale-like sepals slightly united at base, about half as long as the 3–6 cuneiform sulcate scarious pointed petals; stamens as many as the divisions of the calyx, opposite them, with short nearly obsolete filaments, and elongated clavate 2-celled anthers, their cells opening longitudinally and crowned by a capitate pilose truncate connective; calyx of the pistillate flower divided into 3–6, usually 4, rounded sepals much shorter than the acute petals; stamens scale-like, elongated-obovoid, pilose at apex; ovaries as many as the divisions of the calyx, superior, oblong, sessile, surrounded at base by long ridged jointed pale hairs persistent round the fruit, gradually narrowed into long simple bright red styles papillose-stigmatic to below the middle along the ventral suture; ovules 1 or rarely 2, suspended laterally, orthotropous. Head of fruit composed of elongated obovoid akenes rounded and obtuse or acute at apex, surmounted by the persistent styles, 1-seeded, light yellow-brown; pericarp thin, coriaceous. Seed elongated-oblong, suspended; testa thin and firm, light chestnut-brown; embryo erect in thin fleshy albumen; cotyledons oblong, about as long as the elongated cylindric erect radicle turned toward the minute apical hilum. Wood hard and heavy not strong, light brown tinged with red, with numerous broad conspicuous medullary rays and bands of smaller ducts marking the layers of annual growth. A family of a single genus.

1. PLATANUS L. Plane-tree.

Characters of the family.

A genus of four or five species of eastern and western North America, Mexico, Central America, and of southwestern Asia, all resembling each other except in the form of the lobes

of the leaves and the amount of pubescence on their lower surface, in the pointed or obtuse apex of the akene, and in the number of heads of pistillate flowers on their peduncle.

Of the exotic species, the Old World *Platanus acerifolia* Willd., of doubtful origin, and often considered a hybrid between *P. orientalis* L. and the Plane-tree of the eastern United States, is now a common street tree in the cities of all the countries of temperate Europe, and is largely used as a street and shade tree in the eastern states and in California.

Platanus is the classical name of the Plane-tree.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Heads of fruit usually solitary; leaves broadly ovate, slightly 3–5-lobed, the lobes broad, mostly serrulate, or entire, truncate or rarely cuneate at base. 1. **P. occidentalis** (A, C).

Heads of fruit racemose.

Leaves 3–5-lobed to below the middle, the lobes entire, remotely and obscurely dentate, or rarely sinuate-toothed, truncate or slightly cordate or cuneate at base. 2. **P. racemosa** (G).

Leaves deeply 5–7-lobed, the lobes elongated, slender, entire, or rarely remotely dentate, deeply cordate or rarely cuneate or truncate at base. 3. **P. Wrightii** (H).

1. Platanus occidentalis L. Sycamore. Buttonwood.

Leaves broadly ovate, more or less 3–5-lobed by broad shallow sinuses rounded at the bottom, the lobes broad, acuminate, sinuate-toothed with long straight or curved remote acuminate teeth, or entire with undulate margins, truncate or slightly cordate, or long-

Fig. 331

cuneate and decurrent on the petiole at base (var. *attenuata* Sarg.), thin and firm, bright green on the upper surface, paler on the lower, glabrous at maturity with the exception of a slight pubescence on the under side of the thin midrib and stout yellow veins, 4′–7′ long and broad, or twice as large on vigorous shoots and then frequently furnished with dentate basal lobes; petioles stout, terete or slightly angled, becoming puberulous 3′–5′ in length; stipules 1′–1½′ long, entire or sinuate-toothed. **Flowers:** peduncles coated with pale tomentum, bearing 1 and sometimes 2 heads of flowers. **Fruit:** heads 1′ in diameter, on slender glabrous stems 3′–6′ in length; akene about ⅔′ long and truncate or obtusely rounded at apex.

A tree, occasionally 140°–170° high, with a trunk sometimes 10°–11° in diameter above its abruptly enlarged base, often divided near the ground into several large secondary trunks, or rising 70°–80°, with a straight column-like shaft free of branches and with little

dimunition of diameter, massive spreading limbs forming a broad open irregular head sometimes 100° in diameter, their extremities usually erect or more or less pendulous, and slender branchlets coated at first like the leaves, petioles, and stipules with thick pale deciduous tomentum, during their first summer dark green and glabrous, marked by minute oblong pale lenticels, becoming dark orange-brown and rather lustrous during their first winter and light gray in their second year. **Winter-buds** $\frac{1}{4}'$–$\frac{3}{8}'$ long. **Bark** of young trunks and large branches rarely more than $\frac{1}{2}'$ thick, dark reddish brown, broken into small oblong thick appressed plate-like scales, smooth, light gray, and separating higher on the tree into large thin scales, in falling exposing large irregular surfaces of the pale yellow, whitish, or greenish inner bark, becoming at the base of large trunks 2′–3′ thick, dark brown, and divided by deep furrows into broad rounded ridges covered by small thin appressed scales. **Wood** the favorite material for tobacco boxes, ox-yokes, and butcher's blocks, and now largely used for furniture and the interior finish of houses.

Distribution. Borders of streams and lakes on rich bottom-lands; southeastern Maine to northern Vermont and through southern Ontario and Michigan to central and southern Iowa, southeastern Nebraska, eastern Kansas, and eastern Oklahoma to the valley of the Arkansas River (Clay County), and southward to middle Florida (Gadsden County), central Alabama and Mississippi, and the valley of the Rio Grande (Zavalla County) western Texas; common but most abundant and of its largest size on the bottom lands of streams in the basin of the lower Ohio and Mississippi rivers; less abundant and of smaller size in the coast region of the Carolinas and in western Texas; ascending the Appalachian Mountains up to altitudes of 2500°. The most massive if not the tallest deciduous-leaved tree of eastern North America.

Sometimes planted as a street tree, especially in the cities of eastern Texas; passing into

1. Platanus occidentalis var. glabrata Sarg.

Platanus glabrata Fern.

Leaves usually broader than long, truncate, broad-cuneate or rarely cordate at base, 3-lobed by sinuses acute or rounded in the bottom, the lobes long-acuminate, entire, the lateral lobes often furnished near the base with one or rarely with two small acuminate in-

Fig. 332

curved secondary lobes occasionally found also on the terminal lobe, tomentose below and pubescent above when the flowers open the end of March in Texas, later becoming glabrous except on the under side of the midrib and veins, usually about $2\frac{3}{4}'$–$5\frac{1}{2}'$ long and $3'$–$3\frac{1}{2}'$ wide; petioles pubescent, becoming glabrous. Peduncles bearing one or rarely two heads. **Flowers** and **Fruit** like those of the species.

Distribution. Western Texas, common; valley of the Colorado River, near Austin, Travis County, to that of the Devil's River, Valverde County; in Coahuila and Nuovo Leon; rarely northward with widely scattered individuals; the prevailing form on the Edwards Plateau and in the counties adjacent to the Rio Grande.

2. Platanus racemosa Nutt. Sycamore.

Leaves 3–5-lobed to below the middle by broad sinuses acute or rounded in the bottom, the lobes acute or acuminate, entire, dentate with remote callous tipped teeth, or occa-

Fig. 333

sionally coarsely sinuate-toothed, usually cordate or sometimes truncate, or cuneate and decurrent on the petiole at base, thick and firm, light green above, paler and more or less thickly coated below with pale pubescence most abundant along the midrib and primary veins, $6'$–$10'$ long and broad; petioles stout, pubescent, $1'$–$3'$ in length; stipules $1'$–$1\frac{1}{2}'$ long, entire or dentate, often persistent until spring. **Flowers:** peduncles hoary-pubescent, bearing usually 4 or 5 heads of staminate flowers and 2–7 heads of pistillate flowers, a head of the staminate flowers occasionally appearing on the pistillate peduncle above the heads of fertile flowers. **Fruit:** heads $\frac{3}{4}'$ in diameter, on slender zigzag glabrous or pubescent stems $6'$–$9'$ in length; akene acute or rounded at apex, $\frac{1}{3}'$ long, tomentose while young, becoming glabrous.

A tree, 40°–90° high, with a trunk sometimes 9° in diameter above the broad tapering base, erect and free of branches for half its height, more often divided near the ground into secondary stems erect, inclining, or prostrate for 20°–30° at their base, thick heavy more or less contorted spreading branches forming an open irregular round-topped head, and branchlets coated at first with thick pale deciduous tomentum, light reddish brown, and marked by numerous small lenticels in their first winter, becoming gradually darker in their second and third years; usually smaller, with a trunk 2°–4° in diameter. **Winter-buds** nearly $\frac{1}{2}'$ long. **Bark** at the base of old trunks $3'$–$4'$ thick, dark brown, deeply furrowed, with broad rounded ridges separating on the surface into thin scales; thinner, smooth, and pale, or almost white higher on the trunk and on the branches.

Distribution. Banks of the streams of western California; valley of the upper Sac-

ramento River (Tehama County) southward through the interior valleys, along the western foothills of the Sierra Nevada and on the southern coast ranges; and on Mount San Pedro Màrtir in Lower California; exceedingly common in all the valleys of the California coast ranges from Monterey to the southern borders of the state, and ascending the southern slopes of the San Bernardino Mountains to altitudes of 3000°–4000°.

3. Platanus Wrightii S. Wats. Sycamore.

Leaves divided by narrow sinuses to below the middle and sometimes nearly to the center into 3–7 but usually into 3–5 elongated acute lobes entire, or dentate with callous-tipped teeth, or occasionally furnished with 1 or 2 lateral lobes, sometimes deeply cordate by the downward projection of the lower lobes, or often truncate or cuneate at base, thin and firm in texture, light green and glabrous above, covered below with pale pubescence, 6′–8′ long and broad, with a slender midrib, and primary veins connected by conspicuous

Fig. 334

reticulate veinlets; petioles stout, glabrous or puberulous, 1½′–3′ in length. **Flowers:** peduncles hoary-tomentose, bearing 1–4 heads of flowers. **Fruit:** heads on slender glabrous stems 6′–8′ long, about ¾′ in diameter; akenes glabrous, ¼′ long, truncate at apex.

A tree, often 60°–80° high, with a straight trunk 4°–5° in diameter, gradually tapering and free of branches for 20°–30°, or with a trunk divided at the ground into 2 or 3 large stems usually more or less reclining and often nearly prostrate for 15°–20°, thick contorted branches, the lowest growing almost at right angles to the trunk and 50°–60° long, the upper usually erect at first, finally spreading into a broad open handsome head, and slender branchlets coated when they first appear with thick pale tomentum, becoming glabrous or slightly puberulous during their first winter, marked by minute scattered lenticels, and light brown tinged with red or ashy gray, and gradually darker in their second or third year. **Winter-buds** hardly more than ⅛′ long. **Bark** at the base of the trunk dark, 3′–4′ thick, deeply and irregularly divided into broad ridges, and covered on the surface with small appressed scales, thinner and separating into large scales 10°–15° above the ground, and gradually passing into the smooth much thinner creamy white bark faintly tinged with green of the upper branches.

Distribution. Banks of streams in the mountain cañons of southwestern New Mexico and southern Arizona; in northern Arizona in Oak Creek Cañon near Flagstaff (*P. Lowell*); and in Sonora; the largest and one of the most abundant of the deciduous-leaved trees on all the mountain ranges of southern Arizona, extending from the mouth of cañons up to altitudes of 5000°–6000° above the sea.

XXII. ROSACEÆ.

Trees, shrubs and herbs, with watery juices, terete branchlets, scaly buds, and alternate leaves (*opposite in Lyonothamnus*), with stipules. Flowers perfect; calyx 5-lobed; petals 5 (*0 in Cercocarpus*), imbricated in the bud, inserted with the numerous distinct stamens on the edge of a disk lining the calyx-tube; anthers introrse (*extrorse in Vauquelinia*), 2-celled, the cells opening longitudinally; ovary superior in Lyonothamnus and Heteromeles, often partly superior in Amelanchier; ovules 2 in each cell (*1 in Cowania and Cercocarpus, 4 in Lyonothamnus*), anatropous. Seeds without albumen (*albuminous in Lyonothamnus and Cowania*). A family of about ninety genera chiefly confined to the temperate parts of the world and producing many of the most valuable fruits, including the apple, pear, quince, strawberry, raspberry, and blackberry. The six tribes into which the genera of the family are grouped, have arborescent representatives in North America.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT GENERA.

Tribe 1. Spiræoideæ. Fruit a woody capsule.

Flowers in terminal cymose corymbs; calyx-lobes persistent; ovary 5-celled; ovules ascending; mature carpels adherent below and opening down the back; albumen 0; leaves simple. **1. Vauquelinia.**

Flowers in terminal corymbs; calyx-lobes deciduous; ovary 2-celled; ovules 4 in each cell, pendulous; mature carpels opening on the ventral and partly on the dorsal suture; albumen thin; leaves opposite, simple or pinnately divided. **2. Lyonothamnus.**

Tribe 2. Pomoideæ. Fruit a pome composed of the thickened and succulent calyx-tube inclosing the papery or bony carpels; stipules free from the petioles.

Mature carpels papery.

Carpels as many as the styles.

Flowers in few-flowered terminal racemes on short spur-like lateral branchlets; ovary 3–5-celled; styles more or less united below; leaves simple; winter-buds small. **3. Malus.**

Flowers in broad compound terminal cymes; ovary 2–4, usually 3-celled; styles distinct; fruit subglobose; leaves unequally pinnate; winter-buds large. **4. Sorbus.**

Flowers in large terminal corymbose panicles; ovary nearly superior, 2-celled; styles distinct; fruit obovoid. **5. Heteromeles.**

Carpels becoming at maturity twice as many as the styles; flowers in erect or nodding racemes; ovary inferior or partly superior; styles 2–5, more or less united below; fruit subglobose or pyriform; leaves simple, deciduous. **6. Amelanchier.**

Mature carpels bony; flowers in terminal cymose corymbs; ovary 1–5-celled; styles distinct; fruit globose to pyriform; leaves simple, deciduous. **7. Cratægus.**

Tribe 3. Dryadæ. Calyx-tube turbinate, campanulate or hemispheric; petals 5; ovary composed of 1 or several carpels; fruit an akene tipped with the elongated plumose style.

Flowers terminal on short branchlets, solitary; calyx-tube turbinate; carpels 5–12; leaves alternate, toothed or pinnatifid. **8. Cowania.**

Tribe 4. Cercocarpæ. Calyx-tube salver-shaped; petals 0; ovary composed of a single carpel; fruit an akene, tipped with the elongated plumose style.

Leaves alternate, simple, entire or serrate. **9. Cercocarpus.**

Tribe 5. Prunoideæ. Fruit a 1-seeded drupe; ovary 1-celled; style terminal; ovules pendulous.

Flowers in fascicled umbels, or racemes; leaves simple, deciduous or persistent. **10. Prunus.**

Tribe 6. CHRYSOBALANOIDEÆ. Fruit a 1-seeded drupe; ovary 1-celled; style lateral, ovules ascending.

Flowers in axillary or terminal cymose panicles; leaves simple, persistent.

11. Chrysobalanus.

1. VAUQUELINIA Corr.

Trees or shrubs, with slender terete branchlets and scaly bark. Leaves alternate or rarely opposite, lanceolate, serrate, long-petiolate, reticulate-veined, coriaceous, persistent; stipules minute, acute, deciduous. Flowers on slender bibracteolate pedicels, in compound terminal leafy cymose corymbs; calyx short-turbinate, coriaceous, 5-lobed, the lobes ovate, obtuse or acute, erect, persistent; petals 5, orbicular or oblong, white, becoming reflexed, persistent; stamens 15–25, inserted in 3 or 4 series, equal or semiequal, those of the outer row opposite the petals; filaments subulate, exserted, persistent; anthers versatile, extrorse; carpels 5, opposite the sepals, inserted on the thickened base of the calyx-tube and united below into a 5-celled ovoid tomentose ovary crowned with 5 short spreading styles dilated into capitate stigmas; ovules subbasilar, ascending, prolonged at the apex into thin membranaceous wings; raphe ventral; micropyle superior. Fruit a woody ovoid 5-celled tomentose capsule inclosed at the base by the remnants of the flower, the mature carpels adherent below and at maturity splitting down the back. Seeds 2 in each cell, ascending, compressed; testa membranaceous, expanded into a long terminal membranaceous wing; embryo filling the cavity of the seed; cotyledons flat; radicle straight, erect.

Vauquelinia is confined to the New World and is distributed from New Mexico, Arizona and Lower California to southern Mexico. Three species are distinguished; of these one inhabits the mountain ranges of southern Arizona and New Mexico.

The generic name is in honor of the French chemist Louis Nicholas Vauquelin (1763–1829).

1. Vauquelinia californica Sarg.

Leaves narrowly lanceolate, acuminate or rarely rounded at apex, abruptly cuneate or slightly rounded at base, and remotely serrate with minute glandular teeth, when they unfold puberulous above and densely tomentose below, and at maturity coriaceous, bright

Fig. 335

yellow-green and glabrous on the upper and tomentose on the lower surface, $1\frac{1}{2}'$–$3'$ long, $\frac{1}{4}'$–$\frac{1}{2}'$ wide, with a thick conspicuous midrib grooved on the upper side, and numerous thin primary veins connected by reticulate veinlets; deciduous in spring or early summer; petioles thick, $\frac{1}{3}'$–$\frac{1}{2}'$ in length. **Flowers** appearing in June, $\frac{1}{4}'$ in diameter, in hoary-tomentose panicles $2'$–$3'$ across; petals oblong; inner surface of the disk pilose. **Fruit** fully grown by

the end of August, $\frac{1}{4}'$ long, persistent on the branches after opening until the spring of the following year; conspicuous from the contrast of the bright red faded petals and the white silky pubescence of the calyx and carpels; **seed** $\frac{1}{12}'$ long, and one third as long as its wing.

A tree, 18°–20° high, with a slender often hollow trunk 5′–6′ in diameter, rigid upright contorted branches, and slender branchlets at first bright reddish brown and more or less thickly covered with hoary tomentum, becoming light brown or gray in their second year and marked by large elevated leaf-scars; or more often a low shrub. **Winter-buds:** axillary minute, acuminate, reddish brown, pubescent. **Bark** about $\frac{1}{16}'$ thick, dark red-brown, and broken on the surface into small square persistent plate-like scales. **Wood** very heavy, hard, close-grained, dark rich brown streaked with red, with 14 or 15 layers of annual growth.

Distribution. Bottoms and rocky sides of gulches, or on grassy slopes; mountain ranges of extreme southwestern New Mexico (Guadalupe Cañon, teste *E. A. Mearns*), southern Arizona, Sonora, and Lower California; arborescent and of its largest size in Arizona on the Santa Catalina Mountains at altitudes of about 5000° above the sea.

2. LYONOTHAMNUS A. Gray.

A tree or shrub, with scaly bark exfoliating in long strips, stout terrete pubescent ultimately glabrous branchlets, and scaly, acuminate buds. Leaves opposite, long-petiolate, lanceolate, acuminate, rounded or cuneate at base, entire, finely crenulate-serrate or serrulate lobulate below the middle, or sometimes irregularly pinnately parted into 3–8 linear-lanceolate remote lobulate segments, coriaceous, transversely many-veined, dark green above, paler and more or less pubescent below, persistent; stipules lanceolate, acute, minute, caducous. Flowers on slender pedicels, in broad compound terminal pubescent cymose corymbs, with minute acute persistent bracts and bractlets; calyx-tube hemispheric, with 1–3 bractlets, tomentose on the outer surface, the lobes nearly triangular, slightly keeled, apiculate, persistent; disk 10-lobed, with a slightly thickened margin; petals 5, orbicular, sessile, white; stamens 15, inserted in pairs opposite the petals and singly opposite the sepals; filaments subulate, incurved, as long as the petals; anthers oblong, 2-celled, the cells opening longitudinally; carpels 2, inserted in the bottom of the calyx-tube, forming a superior glandular, hairy ovary; styles 2, spreading; stigmas capitate, truncate; ovules 4 in each cell, suspended; micropyle superior; raphe ventral. Fruit of 2 woody ovoid glandular-setulose carpels, dehiscent on the ventral and partly dehiscent on the dorsal suture. Seeds ovate-oblong, pointed at the ends; seed-coat light brown, thin and membranaceous; hilum orbicular, apical; raphe broad and wing-like; cotyledons oblong, acuminate, twice as long as the straight radicle directed toward the hilum.

Lyonothamnus is represented by a single species found only on the islands off the coast of southern California.

Lyonothamnus, in honor of its discoverer, William S. Lyon.

1. Lyonothamnus floribundus A. Gray. Ironwood.

Leaves 4′–8′ long, $\frac{1}{2}'$ wide when entire, or 4′ wide when pinnately divided, when they unfold covered below with hoary deciduous tomentum, at maturity dark green and lustrous above and yellow-green, glabrous or pubescent below, with an orange-colored midrib. **Flowers** in June and July, $\frac{1}{8}'$–$\frac{1}{4}'$ in diameter, in clusters varying from 4′–8′ across. **Fruit** ripens in August and September, $\frac{8}{16}'$ long.

A bushy tree, rarely 30°–40° high, with a single straight trunk 8′–10′ in diameter, and slender branchlets at first pale orange color and coated with deciduous pubescence, becoming at the end of their first season bright red and lustrous; usually shrubby, with several tall stems, or in exposed situations a low bush. **Bark** $\frac{1}{3}'$ thick, dark red-brown, and composed of numerous thin papery layers, forming after exfoliating long loose strips persistent on the stem. **Wood** heavy, hard, close-grained, bright clear red faintly tinged with orange.

Distribution. Steep slopes of cañons in dry rocky soil; on the islands of Santa Catalina, Santa Cruz, San Clemente, Santa Rosa, California; most abundant and of its largest size on

Fig. 336

the northern shores of Santa Cruz; on Santa Catalina much smaller and rarely arborescent. Now occasionally cultivated in California.

3. MALUS Miller. Apple.

Trees, with scaly bark, slender terete branchlets, small obtuse buds covered by imbricated scales, those of the inner ranks accrescent and marking the base of the branchlet with conspicuous ring-like scars, and fibrous roots. Leaves conduplicate in the bud in the American species, simple, often incisely lobed, especially those near the end of vigorous branchlets, petiolate, deciduous, the petioles in falling leaving narrow horizontal scars marked by the ends of three equidistant fibro-vascular bundles; stipules free from the petioles, filiform, early deciduous. Flowers in short terminal racemes, with filiform deciduous bracts and bractlets, on short lateral spur-like often spinescent branchlets; calyx-tube obconic, 5-lobed, the lobes imbricated in the bud, acuminate, becoming reflexed, persistent and erect on the fruit or deciduous; petals rounded at apex, contracted below into a stalk-like base, white, pink or rose color; stamens usually 20 in 3 series, those of the outer series opposite the petals; carpels 3–5, usually 5, alternate with the petals, united into an inferior ovary; styles united at base; ovules 2 in each cell, ascending; raphe dorsal; micropyle inferior. Fruit a pome with homogeneous flesh, and papery carpels joined at apex, free in the middle; seeds 2, or by abortion 1 in each cell, ovoid, acute, erect, without albumen; seed-coat cartilaginous, chestnut-brown and lustrous; embryo erect; cotyledons plano-convex, fleshy; radicle short, inferior. Malus is confined to North America where nine species have been recognized, to western and southeastern Europe, and to central, southern, and eastern Asia. Of exotic species, *Malus pumila* Mill. of southeastern Europe and central Asia, the Apple-tree of orchards, has become widely naturalized in northeastern North America. Several of the species of eastern Asia and their hybrids are cultivated for their handsome flowers, or for their fruits, the Siberian Crabs of pomologists.

Malus is the classical name of the Apple-tree.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Calyx persistent on the green or rarely yellow fruit covered with a waxy exudation; leaves of vigorous shoots laterally lobed; anthers dark (Chloromeles).

Leaves glabrous at maturity.

Leaves on flowering branchlets, acute or acuminate, serrate.
Leaves at the end of vigorous shoots distinctly lobed, those of flowering branchlets incisely serrate or lobed.
Leaves subcordate, with the lowest pair of veins springing directly from the base, light green on the lower surface. **1. M. glabrata** (A).
Leaves truncate or rounded at base, the lowest pair of veins at some distance from the base.
Leaves glaucescent beneath, thickish at maturity. **2. M. glaucescens** (A, C).
Leaves light green on the lower surface, thin. **3. M. coronaria** (A, C).
Leaves at the end of vigorous shoots only slightly lobed, those of flowering branchlets serrate.
Leaves oval-elliptic, acute; fruit much depressed, distinctly broader than high. **4. M. platycarpa** (A, C).
Leaves lanceolate, acuminate, thin; fruit subglobose. **5. M. lancifolia.**
Leaves on flowering branchlets usually rounded at apex, those at the end of vigorous shoots only slightly lobed; fruit subglobose. **6. M. angustifolia** (A, C).
Leaves tomentose or villose at maturity, at least those of vigorous shoots, strongly veined.
Calyx glabrous on the outer surface; leaves of flowering branchlets without lobes, glabrous or nearly so. **7. M. bracteata** (A, C).
Calyx tomentose or pubescent on the outer surface; leaves usually incisely lobed, pubescent or tomentose beneath, rarely glabrous. **8. M. ioensis** (A, C).
Calyx deciduous from the yellow or reddish fruit without a waxy exudation; leaves of vigorous shoots often 3-lobed at apex; anthers yellow (Sorbomalus). **9. M. fusca** (B, G).

1. Malus glabrata Rehd. Crab Apple.

Leaves triangular-ovate or ovate, acute or acuminate at apex, cordate or rarely truncate at base, lobed with 2 or 3 pairs of short-acute or short-acuminate coarsely serrate lobes,

Fig. 337

when they unfold bronze color and sparingly covered with caducous hairs, glabrous when fully expanded, and at maturity dark yellow-green and lustrous above, pale below, $2\frac{1}{2}'$–$3'$ long and $2'$–$2\frac{1}{2}'$ wide, with 5–7 pairs of prominent primary veins, the lowest pair from the base of the leaf; petioles slender, glabrous, $\frac{4}{5}'$–$1\frac{1}{4}'$ in length; leaves at the end of vigorous shoots more deeply lobed and often $4'$ long and $3\frac{1}{2}'$ wide. **Flowers** about $1\frac{1}{4}'$ in diameter,

on slender glabrous purple pedicels $\frac{3}{5}'$–$1\frac{1}{4}'$ long, in 4–7-flowered clusters; calyx-tube purple and glabrous, the lobes glabrous on the outer surface, slightly longer than the tube; petals suborbicular or broadly ovate, abruptly contracted below, about $\frac{3}{5}'$ wide, often erose-denticulate; stamens about one third shorter than the petals; styles 5, slightly longer than the stamens, villose below the middle. **Fruit** on slender pedicels about $\frac{4}{5}'$ in length, depressed globose, slightly angled, distinctly ribbed at the deeply impressed apex, about $1\frac{1}{4}'$ high and $1\frac{1}{2}'$ in diameter, with a deep basal cavity; **seed** obovoid-oblong, about $\frac{1}{3}'$ long.

A tree, 18°–25° high, with a short trunk rarely 1° in diameter, spreading branches often armed with stout straight spines up to $1\frac{1}{2}'$ in length, and glabrous purple branchlets, becoming purple-brown and slightly lustrous at the end of their first season, dull red-brown in their second year, and ultimately grayish brown. **Winter-buds** ovoid or oblong-ovoid, acute, glabrous, dark purple-brown up to $\frac{1}{4}'$ in length.

Distribution. A common Crab Apple in the valleys of western North Carolina at altitudes of 2000°–3500°; near Biltmore, Buncombe County, Dillsboro, Jackson County, and Highlands, Macon County.

2. Malus glaucescens Rehd. Crab Apple.

Leaves triangular-ovate or ovate, acute, short-acuminate or rounded at apex, truncate or rounded at base, those of flowering branchlets more or less lobed and coarsely serrate with abruptly acuminate teeth, their lobes triangular, broad-ovate and abruptly acumi-

Fig. 338

nate, those of the lowest pair usually the longest, bronze color and covered with thin floccose tomentum when they unfold, soon glabrous, dull yellowish green above, glaucescent below, $1\frac{1}{2}'$–$3\frac{1}{2}'$ long and $1\frac{1}{4}'$–$3'$ wide, with 4–7 pairs of prominent primary veins; turning yellow or dark purple and falling early in the autumn; petioles slender, slightly villose at first, soon glabrous, $1\frac{1}{2}'$–$3'$ in length; stipules filiform, purple, glabrous or slightly villose, about $\frac{1}{3}'$ long; leaves at the end of vigorous shoots broad-ovate, acuminate, rounded or slightly cordate at base, often deeply lobed, $3'$–$3\frac{1}{2}'$ long, $3'$ wide, with petioles $1\frac{1}{2}'$–$2'$ in length. **Flowers** $1\frac{1}{3}'$–$1\frac{1}{2}'$ in diameter, on slender glabrous pedicels, $\frac{2}{5}'$–$1\frac{1}{4}'$ in length, in usually 5–7-flowered clusters, calyx-tube coated with floccose caducous pubescence or glabrous, slightly shorter than the long-acuminate lobes densely tomentose on the inner surface; petals oval, abruptly contracted below into a long claw, white or rose color, $\frac{1}{2}'$–$\frac{3}{5}'$ wide; stamens about one third shorter than the petals; styles 5, about as long as the stamens, densely villose below and united at base for about one fourth of their length. **Fruit**

depressed globose, pale yellow when ripe, 1′–1¼′ high, 1¼′–1¾′ in diameter, with a shallow only slightly corrugated cavity at apex and a shallow concave depression at base.

An arborescent shrub or small tree, rarely more than 15° high, often spreading into thickets, with a trunk 4′ or 5′ in diameter, spreading spinescent branches forming an open irregular head, and slender branchlets slightly pubescent at first, soon glabrous, bright red-brown in their first and second years, becoming dark gray-brown and marked by yellow lenticels. **Bark** dark gray, divided by shallow longitudinal fissures and finally separating into small thin scales.

Distribution. Glades and open woods in rich soil; western New York (Ontario, Monroe, Cattaraugus and Erie Counties) to southern Ontario, western Pennsylvania (near Carnot, Allegheny County); and southeastern and northern Ohio; Tiptop, Tazewell County, Virginia; near Spruce Pine, Mitchell County, North Carolina; slopes of Lookout Mountain, above Valleyhead, DeKalb County, Alabama; apparently most generally distributed and most abundant in Ohio.

3. Malus coronaria L. Crab Apple. Garland Tree.

Leaves ovate to oval, rounded, acute or acuminate and often abruptly short-pointed at apex, rounded or cuneate at base, and coarsely serrate usually only above the middle, tinged with red and villose-pubescent when they unfold, soon glabrous, and at maturity

Fig. 339

yellow-green above, paler below, 2′–3′ long and 1½′ wide, with a prominent midrib and thin inconspicuous primary veins; turning yellow in the autumn before falling; petioles slender, at first puberulous, becoming glabrous, ½′–1′ in length; leaves at the end of vigorous shoots broad-ovate, usually lobed with short acute lobes, more coarsely serrate, thicker, often 3′–4′ long and 2′–3′ wide, with a prominent midrib and primary veins, and stout petioles often tinged with red and 1½′–2′ in length. **Flowers** 1¼′–1½′ in diameter, on glabrous pedicels ½′–1′ long, in 3–6-flowered clusters: calyx-tube glabrous, or rarely more or less densely villose-pubescent (var. *dasycalyx* Rehd.), the lobes long-acuminate, longer than the tube, sparingly pubescent on the outer surface, hoary-tomentose on the inner surface; petals oblong-obovate, gradually or abruptly narrowed into a long claw, about ½′ wide; stamens shorter than the petals; styles 5, clothed for half their length with long white hairs and united at the base. **Fruit** on slender pedicels 1½′–2′ in length, green when fully grown, yellow-green at maturity, ¾′–1′ high and 1′–1¼′ wide.

A tree, often forming dense thickets, 25°–30° high, with a trunk 12′–14′ in diameter, dividing 8°–10° above the ground into several stout spreading branches forming a wide open head, and branchlets hoary-tomentose when they first appear, glabrous or slightly pubescent, bright red-brown and marked by occasional small pale lenticels in their first winter, and

developing in their second year stout, spur-like, somewhat spinescent lateral branchlets. **Winter-buds** obtuse, with bright red scales scarious and ciliate on the dark margins. **Bark** $\frac{1}{3}'$ thick, longitudinally fissured, the outer layer separating into long narrow persistent red-brown scales. **Wood** heavy, close-grained, not strong, light red, with yellow sapwood of 18–20 layers of annual growth; used for levers, the handles of tools, and many small domestic articles.

Distribution. Western New York to southern Ontario and westward through Ohio, southern Michigan, Indiana, Illinois, and southern Wisconsin to Missouri (Jackson and Butler Counties), and southward through Pennsylvania to northern Delaware, and along the Appalachian Mountains to North Carolina, sometimes up to altitudes of 3300°; the var. *dasycalyx* common and widely distributed in Ohio (Lorain, Clark, Franklin, Hardin and Lucas Counties, *R. E. Horsey*), and in Wells and Porter Counties, Indiana (*C. C. Deam*).

Sometimes planted in the gardens of the northern and eastern states; passing into

Malus coronaria var. elongata Rehd.

Malus elongata Ashe.

Leaves oblong-ovate, gradually narrowed and acuminate at apex, rounded or broad-cuneate at base, incisely serrate or slightly lobed, floccose-tomentose when they unfold, soon glabrous, dark yellow-green above, lighter below, $2'–3\frac{1}{2}'$ long, $1'–1\frac{1}{4}'$ wide; at the end of vig-

Fig. 340

orous shoots ovate, rounded or broad and cuneate at base, acuminate, lobed with short acuminate lobes, $3\frac{1}{2}'–4'$ long, $2'–2\frac{1}{2}'$ wide, with a prominent midrib and primary veins, and slightly pubescent orange-colored petioles $1'–1\frac{1}{2}'$ in length. **Flowers** and **Fruit** as in the species.

A shrub or small tree, sometimes forming dense almost impenetrable thickets.

Distribution. Western New York (Ontario, Cattaraugus and Erie Counties); Virginia (on Peak Mountain, Pulaski County); West Virginia (near Elkins, Randolph County, and White Sulphur Springs, Greenbrier County), and westward to southern Ohio (Oberlin, Lorain County); North Carolina (near Highlands, Macon County); and northeastern Georgia (Rabun County).

4. Malus platycarpa Rehd. Crab Apple.

Leaves ovate to elliptic, abruptly contracted at the rounded apex into a short point, rounded at base, and sharply usually doubly serrate, when they unfold covered with long

white hairs caducous except from the midrib and at maturity glabrous; dark yellow-green, lustrous, and slightly rugulose on the upper surface, lighter on the lower surface, $2\frac{1}{2}'$–$3\frac{1}{4}'$ long and $1\frac{1}{2}'$–$2\frac{1}{2}'$ wide, with 5–7 pairs of prominent primary veins; petioles slender, villose, often becoming nearly glabrous, $1'$–$1\frac{1}{2}'$ in length; on vigorous shoots often broad-ovate and lobed with short triangular lobes sometimes $4'$ long and nearly as wide. **Flowers** about $1\frac{1}{2}'$ in diameter, on glabrous pedicels $1\frac{1}{2}'$–$2\frac{1}{2}'$ long, in 3–6-flowered clusters; calyx-tube glabrous or rarely pubescent (var. *Hoopesii* Rehd.), the lobes lanceolate, acuminate, longer than the tube, glabrous on the outer surface, densely tomentose on the inner surface; petals orbicular-obovate, usually irregularly incisely dentate and abruptly contracted at base into a short claw, slightly villose on the inner surface near the base, $\frac{1}{2}'$ to

Fig. 341

nearly $1'$ wide; stamens slightly shorter than the petals; styles 5, somewhat shorter than the stamens, villose below the middle and united below for one third their length. **Fruit** on slender pedicels, $1\frac{1}{4}'$–$1\frac{1}{2}'$ in length, depressed globose with a deep cavity at base and apex, $1\frac{1}{2}'$–$1\frac{3}{4}'$ high and $2'$–$2\frac{1}{2}'$ wide; **seeds** oblong-obovoid, about $\frac{1}{3}'$ long.

A tree, 18°–20° high, with a trunk $4'$ or $5'$ in diameter, spreading unarmed branches, and branchlets clothed when they first appear with thin villose tomentum, becoming by the end of their first year glabrous, brown or purple-brown and lustrous, dull brown in their second season, and ultimately grayish brown. **Winter-buds** ovoid, acute, glabrous except on the villose margins of the purplish brown scales, about $\frac{1}{4}'$ long.

Distribution. Near Franklin, Macon County, North Carolina; Mercer Springs, Mercer County, West Virginia; near Olympia, Bath County, Kentucky; Youngstown, Mahoning County, Ohio (*R. E. Horsey*).

5. Malus lancifolia Rehd. Crab Apple.

Leaves ovate-lanceolate to oblong-lanceolate, acute or short-acuminate at apex, rounded or broad-cuneate at base, finely or coarsely doubly serrate with short or occasionally with larger teeth pointing forward, covered with thin floccose tomentum when they unfold, soon glabrous, bright yellow-green, $1\frac{1}{2}'$–$3'$ long, $\frac{1}{2}'$–$1'$ wide, with 8–10 pairs of veins; petioles slender, slightly villose at first, soon glabrous, $\frac{1}{2}'$–$1'$ in length; leaves on vigorous shoots ovate or oblong-ovate, slightly lobed, more densely pubescent below, $2\frac{1}{2}'$–$3\frac{3}{4}'$ long, $2'$–$2\frac{1}{2}'$ wide, with a thin midrib and 4–7 pairs of veins slightly villose through the season, and stouter petioles. **Flowers** $1\frac{1}{4}'$–$1\frac{1}{2}'$ in diameter, in 3–6-flowered clusters, on slender glabrous pedicels about $1\frac{1}{4}'$ in length; calyx glabrous, the lobes longer than the tube, oblong-lanceolate, glabrous on the outer surface, coated with villose tomentum on the inner surface;

petals contracted into a long narrow claw, glabrous, white or rose color, $\frac{1}{2}'$ wide; stamens shorter than the petals; styles 5, densely villose below the middle. **Fruit** on slender drooping pedicels about 1′ long, subglobose, 1′–$1\frac{1}{4}'$ wide.

A tree, 20°–25° high, with a trunk 12′–15′ in diameter, spreading spinescent branches forming an open pyramidal head, and slender branchlets slightly pubescent or nearly gla-

Fig. 342

brous when they first appear, becoming reddish brown at the end of their first season and ultimately gray-brown. **Bark** of the trunk brownish gray, divided by shallow longitudinal fissures and separating into thin plates.

Distribution. Northeastern Pennsylvania (Scranton, Lackawanna County) to the western and southwestern parts of the state, and southward to Randolph and Greenbrier Counties, West Virginia, Pulaski County (on Peak Mountain), Virginia, and to the mountains of North Carolina up to altitudes of 3200°, and westward to northeastern Kentucky, through southern Ohio, eastern Indiana (Delaware County) and southern Illinois (Richland, Jackson, Gallatin and Pope Counties); Missouri (Jackson and Wayne Counties).

6. Malus angustifolia Michx. Crab Apple.

Leaves elliptic to oblong-obovate, rounded or acute and apiculate at apex, gradually narrowed and cuneate at base, and crenately serrate, hoary-tomentose below and sparingly villose above when they unfold, soon glabrous, or occasionally pubescent on the midrib below, and at maturity subcoriaceous dull green on the upper and light green on the lower surface, 1′–2′ long, $\frac{1}{2}'$–$\frac{3}{4}'$ wide; turning brown in drying; petioles slender, at first villose, soon glabrous, $\frac{1}{2}'$–$\frac{3}{4}'$ in length; stipules linear, rose-colored, $\frac{1}{3}'$ long; leaves at the end of vigorous shoots ovate, oblong-ovate or elliptic, usually lobed with numerous short acute lobes, or coarsely serrate, usually rounded at apex, broad-cuneate at base, at maturity glabrous, or slightly floccose-pubescent below, especially on the midrib and veins, 2′–3′ long, $1\frac{1}{2}'$–2′ wide, with stout often rose-colored glabrous or pubescent petioles. **Flowers** about 1′ in diameter, very fragrant, on slender glabrous or rarely puberulous pedicels, $\frac{3}{4}'$–1′ long, in mostly

3–5-flowered clusters; calyx-tube short and broad, glabrous, the lobes about as long as the tube, glabrous on the outer surface, thickly covered with hoary tomentum on the inner surface; petals oblong-obovate, gradually narrowed below into a long claw, rose-colored, about $\frac{1}{4}'$ wide; stamens shorter than the petals; styles 5, united at base, villose below the middle. **Fruit** depressed-globose, pale yellow-green, $\frac{3}{4}'$–$1'$ in diameter.

A tree, rarely 30° high, with a short trunk 8′–10′ in diameter, rigid spreading or rarely slender and pendulous (var. *pendula* Rehd.) branches forming a broad open head, and young branchlets clothed at first with pale caducous pubescence, soon glabrous, in their first winter brown slightly tinged with red, and in their second year light brown and marked by occasional orange-colored lenticels. **Winter-buds** $\frac{1}{10}'$ long, chestnut-brown,

Fig. 343

slightly pubescent. **Bark** $\frac{3}{8}'$–$\frac{1}{4}'$ thick, dark reddish brown, and divided by deep longitudinal fissures into narrow ridges broken on the surface into small persistent plate-like scales. **Wood** heavy, hard, close-grained, light brown tinged with red, with thick yellow sapwood; occasionally employed for levers, the handles of tools and other small objects. The fruit is used for preserves.

Distribution. Southeastern Virginia in the neighborhood of the coast, southward to western Florida, and through southern Alabama and Mississippi to western Louisiana (near Winnfield, Winn County); in the Carolinas and Georgia, ranging inland to the Appalachian foothills and in Mississippi to the neighborhood of Iuka, Tishomingo County in the northeastern corner of the state; in southern Illinois (Pope and Johnson Counties. *E. J. Palmer*).

7. Malus bracteata Rehd.

Leaves elliptic-ovate to oblong-ovate, acute, on flowering branchlets sometimes obtusish at apex, cuneate or rounded at base, serrate or incisely serrate, sometimes slightly lobed near the base, covered below with floccose tomentum when they unfold, soon glabrous, and at maturity thin, bright yellow-green and lustrous above, light green below, $1\frac{1}{2}'$–$3'$ long, $1'$–$1\frac{1}{4}'$ wide; petioles glabrous, reddish like the under side of the midrib, $\frac{2}{3}'$–$1'$ in length; leaves at the end of vigorous shoots ovate, acute, cuneate at base, usually lobed with 4 or 5 pairs of short acute or rounded lobes, more thickly tomentose when they unfold, at maturity thicker, glabrous above, more or less pubescent below, often $3'$–$3\frac{1}{2}'$ long and $2'$–$2\frac{1}{2}'$ wide, with a stout midrib and petiole. **Flowers** $1'$–$1\frac{1}{4}'$ in diameter, on slender glabrous or nearly glabrous pedicels, in 3–5-flowered clusters, with subulate bractlets $\frac{1}{5}'$–$\frac{1}{3}'$ long, often persistent until after the flowers open; calyx-tube glabrous, the lobes slightly longer than the tube, villose on the inner surface; petals oval, narrowed into a slender claw, deep

pink, $\frac{5}{12}'$–$\frac{1}{2}'$ wide; stamens about one third shorter than the petals; styles slightly shorter than the stamens, united at base and villose below for a third of their length. **Fruit** depressed-globose, with a shallow basal cavity and a shallow slightly corrugated cavity at apex, slightly viscid, $\frac{4}{5}'$–$1'$ high and $1'$–$1\frac{1}{4}'$ wide.

Fig. 344

A tree, 15°–30° high, with a trunk up to 6′ or 7′ in diameter, thick branches forming a broad often symmetrical head, and stout branchlets red and glabrous when they first appear, becoming reddish brown and lustrous at the end of their first season, and dull red-brown and armed with occasional stout spines or unarmed the following year, the vigorous shoots more or less pubescent early in the season, becoming glabrous, or often densely pubescent until autumn. **Winter-buds** red-brown, glabrous, or slightly pubescent. **Bark** dark brown and broken into thin closely appressed scales.

Distribution. Missouri (Allenton, St. Louis County, and Campbell, Dunklin County); northern Kentucky (Fordsville, Ohio County); Tennessee, without locality; North Carolina (Biltmore, Buncombe County, near Highlands, Macon County, up to altitudes of 3500°, and Abbottsburg, Bladen County); Georgia (Dillard, Rabun County, near Augusta, Richmond County); Florida (River Junction, Gadsden County).

8. Malus ioensis Britt. Crab Apple.

Leaves elliptic to ovate or oblong-obovate, acute, acuminate or rounded at apex, cuneate or rounded at the narrow base, crenately serrate, and often slightly lobed with acute or rounded lobes, hoary-tomentose below and floccose-pubescent above when they unfold, and at maturity thick and firm, dark green, lustrous and glabrous above, pale yellow-green and tomentose or nearly glabrous below, $2\frac{1}{2}'$–$4'$ long, $1'$–$1\frac{1}{2}'$ wide, with a slender midrib and primary veins; turning yellow in the autumn before falling; petioles slender, hoary-tomentose in early spring, becoming pubescent or nearly glabrous, $\frac{3}{4}'$–$1'$ in length; leaves at the end of vigorous shoots broad-ovate to oblong-ovate, acute, rounded at the broad or narrow base, often deeply lobed, covered below through the season with floccose easily detached tomentum, often $4'$ or $5'$ long and $3'$ or $4'$ wide, with a thick midrib and primary veins, and stout hoary-tomentose petioles $\frac{3}{4}'$–$1'$ in length. **Flowers** $1\frac{1}{2}'$–$2'$ in diameter, on villose pubescent pedicels $1'$–$1\frac{1}{2}'$ long, in 3–6-flowered clusters; calyx covered with hoary tomentum, the lobes narrow, rather longer than the tube; petals obovate, gradually narrowed below into a long slender claw, rose color or white, about $\frac{1}{2}'$ wide; stamens shorter than the petals; styles 5, united at base, covered below for a third of their length with long white hairs.

Fruit on stout tomentose or villose stems 1′–1½′ long, depressed globose, with shallow basal and apical depressions, green or greenish yellow, ¾′–1′ high, and 1′–1¼′ wide.

A tree, 20°–30° high, with a trunk 12′–18′ in diameter, stout spreading branches forming a wide open head, and branchlets hoary-tomentose when they first appear, glabrous or

Fig. 345

slightly pubescent, bright red-brown and marked by occasional small pale lenticels in their first winter, the lateral branchlets usually spinescent. **Winter-buds** minute, obtuse, pubescent above the middle. **Bark** ⅓′ thick, covered with long narrow persistent red-brown scales.

Distribution. Southeastern Minnesota to Iowa, eastern Nebraska, and Missouri, and through southern Wisconsin and Illinois to Huntington County, Indiana. Passing into var. *Palmeri* Rehd., differing from the type in its smaller oblong more thinly pubescent leaves usually rounded at apex, those of the flowering branchlets crenately serrate and not lobed; a small tree rarely more than 15° high, with a slender stem, spiny zigzag branches and stout branchlets densely tomentose when they first appear, becoming glabrous or nearly glabrous and reddish or gray-brown at the end of their first season; the common form in Missouri, Arkansas and eastern Oklahoma. On the Edwards Plateau, in western Texas (Blanco, Kendall, and Kerr Counties) *M. ioensis* is represented by the var. *texana* Rehd., differing in its smaller and broader leaves only slightly or not at all lobed and densely villose through the season; usually an intricately branched shrub forming large dense thickets. A shrub from Campbell, Dunklin County, southeastern Missouri, with small leaves and flowers, a glabrescent calyx, and long slender flexible branches armed with numerous long straight spines is distinguished as var. *spinosa* Rehd. A variety with elliptic-ovate to oblong-ovate leaves rounded or broadly cuneate at base, nearly entire or crenately serrate, pubescent below at least on the veins, with densely villose petioles is distinguished as var. *creniserrata* Rehd.; a small tree with slender spineless branchlets villose while young; near Pineville, Rapides Parish, and Crowly, Arcadia Parish, western Louisiana. A variety with less deeply lobed glabrescent oblong-lanceolate leaves is distinguished as var. *Bushii* Rehd.; Williamsville, Wayne County, and Monteer, Shannon County, southern Missouri.

Malus ioensis var. *plena* Rehd., the Bechtel Crab, a form with large rose-colored double flowers is a favorite garden plant.

× *Malus Soulardii* Britt. with ovate, elliptic or obovate usually obtuse leaves, rugose and tomentose on the lower surface, and depressed-globose fruit 2′–2½′ in diameter, is believed to be a hybrid of *Malus ioensis* and *Malus pumila*.

9. Malus fusca Schn. Crab Apple.

Malus rivularis Roem.

Leaves ovate to elliptic or lanceolate, acute or acuminate, cuneate or rounded at base, sharply serrate with appressed glandular teeth, and often slightly 3-lobed, when they unfold pubescent on the lower and puberulous on the upper surface, at maturity thick and firm, dark green and glabrous above, pale and pubescent or glabrous below, 1′–4′ long, $\frac{1}{2}$′–$1\frac{1}{2}$′ wide, with a prominent midrib and primary veins and conspicuous reticulate veinlets; before falling in the autumn turning bright orange and scarlet; petioles stout, rigid,

Fig. 346

pubescent, 1′–$1\frac{1}{2}$′ in length; stipules narrowly lanceolate, acute, $\frac{1}{2}$′–$\frac{3}{4}$′ long; leaves at the end of vigorous shoots ovate to obovate, acuminate, often 3-lobed above the middle, rounded or cuneate at base, $2\frac{1}{2}$′–$3\frac{1}{2}$′ long and wide, with petioles often 2′ in length. **Flowers** $\frac{3}{4}$′ in diameter on slender pubescent or glabrous pedicels, $\frac{1}{2}$′–$\frac{3}{4}$′ long, in short many-flowered clusters; calyx-tube deciduous from the mature fruit, glabrous, puberulous or tomentose, the lobes rather longer than the tube, minutely apiculate, glabrous or tomentose, hoary-tomentose on the inner surface; petals orbicular to obovate, erose or undulate on the margins, abruptly contracted into a short claw, $\frac{1}{4}$′ wide, white or rose color; styles 2–4, glabrous. **Fruit** obovoid-oblong, $\frac{1}{2}$′–$\frac{3}{4}$′ long, yellow-green, light yellow flushed with red or sometimes nearly red; flesh thin and dry.

A tree, 30°–40° high, with a trunk 12′–18′ in diameter, and slender branchlets coated at first with long pale hairs soon deciduous or persistent until the autumn, becoming bright red and lustrous, and later dark brown, and marked by minute remote pale lenticels; often a shrub with numerous slender stems. **Winter-buds** $\frac{1}{16}$′ long, chestnut-brown, the inner scales at maturity lanceolate, usually bright red, and nearly $\frac{1}{2}$′ in length. **Bark** $\frac{1}{4}$′ thick, and covered by large thin loose light red-brown plate-like scales. **Wood** heavy, hard, close-grained, light brown tinged with red, with lighter colored sapwood of 20–30 layers of annual growth; used for mallets, mauls, the handles of tools, and the bearings of machinery. The fruit has a pleasant subacid flavor.

Distribution. Deep rich soil in the neighborhood of streams, often forming almost impenetrable thickets of considerable extent; Aleutian Islands southward along the coast and islands of Alaska and British Columbia to Sonoma and Plumas Counties, California; of its largest size in the valleys of western Washington and Oregon.

Occasionally cultivated as an ornamental plant in the eastern states, and in western Europe.

× *Malus Dawsoniana* Rehd., a hybrid of *Malus fusca* and a form of *M. pumila*, has been raised at the Arnold Arboretum from seeds collected in Oregon.

4. SORBUS L. Mountain Ash.

Trees or shrubs, with smooth aromatic bark, stout terete branchlets, large buds covered by imbricated scales, the inner accrescent and marking the base of the branchlet by conspicuous ring-like scars, and fibrous roots. Leaves alternate, pinnate in the American species, the pinnæ conduplicate in the bud, serrate, deciduous; stipules free from the petioles, foliaceous. Flowers in broad terminal leafy cymes; calyx-tube urn-shaped, 5-lobed, the lobes imbricated in the bud, persistent; petals rounded, abruptly narrowed below, white; stamens usually 20 in 3 series, those of the outer series opposite the petals; carpels 2–5, usually 3; styles usually 3, distinct; ovules 2 in each cell, ascending; raphe dorsal; micropyle inferior. Fruit a small subglobose red or orange-red pome with acid flesh, and papery carpels free at the apex. Seeds 2, or by abortion 1, in each cell, ovoid, acute, erect; seed-coat cartilaginous, chestnut-brown and lustrous; embryo erect; cotyledons plano-convex, flat; radicle short, inferior.

Sorbus is widely distributed through the northern and elevated regions of the northern hemisphere with three or four species in North America of which one is arborescent, and with many species in eastern Asia and in Europe. Of the exotic species, *Sorbus Aucuparia* L., the common European Mountain Ash, or Rowan-tree, with several of its varieties and hybrids, is often cultivated as an ornamental tree in Canada and the northern states and has become sparingly naturalized northward.

Sorbus is the classical name of the Pear or of the Service-tree.

1. Sorbus americana Marsh.

Leaves 6′–8′ long, with 13–17 lanceolate acute taper-pointed leaflets unequally cuneate or rounded and entire at base, sharply serrate above with acute often glandular teeth, sessile or short-stalked, or the terminal leaflet on a stalk sometimes ½′ long, when they unfold slightly pubescent below, at maturity membranaceous, glabrous, dark yellow-green, on the upper surface, and paler or glaucescent and rarely pubescent on the lower surface, 2′–4½′ long, ¼–1′ wide, with a prominent midrib and thin veins; turning bright clear yellow before falling in the autumn; petioles grooved, dark green or red, 2′–3′ in length, the rachis often furnished with tufts of dark hairs at the base of the petiolules; stipules broad, nearly triangular, variously toothed, caducous. **Flowers** appearing after the leaves are fully grown, ⅛′ in diameter, on short stout pedicels, in flat cymes 3′–4′ across, with acute minute caducous bracts and bractlets; calyx broadly obconic and puberulous, with short,

Fig. 347

nearly triangular lobes tipped with minute glands and about half as long as the nearly orbicular creamy white petals. **Fruit** $\frac{1}{4}'$ in diameter, subglobose or slightly pyriform, bright orange-red, with thin flesh; **seeds** pale chestnut color, rounded at apex, acute at base, about $\frac{1}{8}'$ long.

A tree, 20°–30° high, with a trunk rarely more than a foot in diameter, spreading slender branches forming a narrow round-topped head, and stout branchlets pubescent at first, soon glabrous, becoming in their first winter brown tinged with red, and marked by the large leaf-scars and by oblong pale remote lenticels, and darker in their second year, the thin papery outer layer of bark then easily separable from the bright green fragrant inner layers; more often a tall or sometimes a low shrub, with numerous stems. **Winter-buds** acute, $\frac{1}{4}'$–$\frac{3}{4}'$ long, with dark vinous red acuminate scales rounded on the back, more or less pilose, covered with a gummy exudation, the inner scales hoary-tomentose in the bud. **Bark** $\frac{1}{8}'$ thick, with a smooth light gray surface irregularly broken by small appressed plate-like scales. **Wood** close-grained, light, soft and weak, pale brown, with lighter colored sapwood of 15–20 layers of annual growth. The astringent fruit is employed domestically in infusions and decoctions, and in homœopathic remedies.

Distribution. Borders of swamps and rocky hillsides; Newfoundland to Manitoba and southward through the maritime provinces of Canada, Quebec and Ontario, the elevated portions of the northeastern United States and the region of the Great Lakes to Minnesota, and on the Appalachian Mountains from western Pennsylvania and West Virginia to North Carolina and Tennessee; in North Carolina ascending to altitudes of nearly 6000°; probably of its largest size on the northern shores of Lakes Huron and Superior; in the United States, except in New England, more often a shrub than a tree; on the Appalachian Mountains usually low, with narrower leaflets and smaller fruit than northward.

Often cultivated in Canada and the northeastern States for the beauty of its fruit and the brilliancy of its autumn foliage. Of its forms the most distinct is

Sorbus americana var. decora Sarg.

Pyrus sambucifolia A. Gray, not Cham. and Schlecht.
Pyrus americana var. *decora* Sarg.
Sorbus decora Schn.
Sorbus scopulina Britt., in part, not Greene.
Pyrus sitchensis Rob. and Fern., not Piper.

Leaves 4′–6′ long, with 7–13 oblong-oval to ovate-lanceolate leaflets blunt and rounded, abruptly short-pointed or acuminate at apex, pubescent below as they unfold, at matu-

Fig. 348

rity glabrous, dark bluish green on the upper surface and pale on the lower surface; petioles stout, usually red 1½′–2′ in length. **Flowers** ¼′ in diameter, in rather narrower clusters, appearing eight to ten days later than those of the type. **Fruit** subglobose, bright orange-red, often ½′ in diameter.

A tree, occasionally 30° high, with a trunk sometimes a foot in diameter, and spreading branches forming a round-topped handsome head.

Distribution. Coast of Labrador to the northern shores of Lake Superior and Minnesota, southward to the mountains of northern New Hampshire, Vermont, and New York. Distinct in its extreme forms but connected with *Sorbus americana* by intermediate forms.

This variety of *Sorbus americana*, perhaps the most beautiful of the genus when the large and brilliant fruits cover the branches in autumn and early winter, occasionally finds a place in the gardens of eastern Canada and the northern states.

5. HETEROMELES Roem.

A tree, with smooth pale aromatic bark, stout terete branchlets pubescent or puberulous while young, acute winter-buds covered by loosely imbricated red scales, and fibrous roots. Leaves oblong-lanceolate, acute at the ends, sharply and remotely serrate with rigid glandular teeth, or rarely almost entire, dark green and lustrous above, paler below, feather-veined, with a broad midrib and conspicuous reticulate veinlets; petiolate with stout petioles often furnished near the apex with 1 or 2 slender glandular teeth; stipules free from the petioles, subulate, rigid, minute, early deciduous. Flowers on short stout pedicels, in ample tomentose terminal corymbose leafy panicles, their bracts and bractlets acute, minute, usually tipped with a small gland, caducous; calyx-tube turbinate, tomentose below, glabrate above, the lobes short, nearly triangular, spreading, persistent; disk cup-shaped, obscurely sulcate; petals flabellate, erose-denticulate or emarginate at apex, contracted below into a short broad claw, thick, glabrous, pure white; stamens 10, inserted in 1 row with the petals in pairs opposite the calyx-lobes; filaments subulate, incurved, anthers oblong-ovoid, emarginate; carpels 2, adnate to the calyx-tube, and slightly united into a subglobose tomentose nearly superior ovary; styles distinct, slightly spreading, enlarged at apex into a broad truncate stigma; ovules 2 in each cell, ascending; raphe dorsal; micropyle inferior. Fruit obovoid, fleshy, the thickened calyx-tube connate to the middle only with the membranaceous carpels coated above with long white hairs filling the cavity closed by the infolding of the thickened persistent calyx-lobes, their tips erect and crowning the fruit. Seed usually solitary in each cell, ovoid, obtuse, slightly ridged on the back; seed-coat membranaceous, slightly punctate, light brown; hilum orbicular, conspicuous; embryo filling the cavity of the seed; cotyledons plano-convex; radicle short, inferior.

The genus is represented by a single species of western North America.

The generic name, from ἕτερος and μῆλον, is in reference to its difference from related genera.

1. Heteromeles arbutifolia Roem. Tollon. Toyon.

Leaves appearing with the flowers in early summer, 3′–4′ long, 1′–1½′ wide, usually persistent during at least two winters; petioles ½′–⅔′ in length. **Flowers** opening from June to August in clusters 4′–6′ across and often more or less hidden by young lateral branchlets rising above them. **Fruit** ripening in November and December, mealy, astringent and acid, scarlet or rarely yellow, ⅓′ long, remaining on the branches until late in the winter.

A tree, sometimes 30° high, with a straight trunk 12′–18′ in diameter, dividing a few feet above the ground into many erect branches forming a handsome narrow round-topped head, and slender branchlets covered at first with pale pubescence, in their first winter dark red and slightly puberulous, ultimately becoming darker and glabrous. **Winter-buds** ¼′ long. **Bark** ⅔′–½′ thick, light gray, with a generally smooth surface roughened by ob-

scure reticulate ridges. **Wood** very heavy, hard, close-grained, dark red-brown, with thin lighter colored sapwood of 7 or 8 layers of annual growth. The fruit-covered branches are gathered in large quantities and used in California in Christmas decorations.

Distribution. Usually in the neighborhood of streams or on dry hills and especially on their northern slopes, and often on steep sea-cliffs; California: coast region from Mendocino County to Lower California; most common and of its largest size on the islands off

Fig. 349

the California coast; on the foothills of the Sierra Nevada and on the San Bernardino Mountains up to altitudes of 2000° above the sea and usually shrubby; very abundant and forming groves of considerable extent on the island of Santa Catalina.

Occasionally cultivated as an ornamental plant in California, and rarely in the countries of southern Europe.

6. AMELANCHIER Med.

Trees or shrubs, with scaly bark, slender terete branchlets, acute or acuminate buds, with imbricated scales, those of the inner rows accrescent and bright-colored, and fibrous roots. Leaves alternate, conduplicate in the bud, simple, entire or serrate, penniveined, petiolate, deciduous; stipules free from the petioles, linear, elongated, rose color, caducous. Flowers in erect or terminal racemes, on slender bibracteolate pedicels developed from the axils of lanceolate acuminate pink deciduous bracts; calyx-tube campanulate or urceolate, the lobes acute or acuminate, recurved, persistent on the fruit; disk green, entire or crenulate, nectariferous; petals white, obovate-oblong, spatulate or ligulate, rounded, acute or truncate at apex, gradually contracted below into a short slender claw; stamens usually 20, inserted in 3 rows, those of the outer row opposite the petals; filaments subulate, persistent on the fruit, anthers oblong; ovary inferior or superior, more or less adnate to the calyx-tube, the summit glabrous or tomentose, 5-celled, each cell incompletely divided by a false partition; styles 2–5, connate below, spreading and dilated above into a broad truncate stigma; ovules 2 in each cell, erect; micropyle inferior. Fruit subglobose or pyriform, dark blue or bluish black, often covered with a glaucous bloom, open at the summit, the cavity surrounded by the lobes of the calyx and the remnants of the filaments; flesh sweet, dry or juicy; carpels membranaceous, free or connate, glabrous, or villose at apex. Seeds 10 or often 5 by the abortion of 1 of the ovules in each cell, ovoid-ellipsoid; seed-coat coriaceous, dark chestnut-brown, mucilaginous; embryo filling the cavity of the seed; cotyledons plano-convex; radicle inferior.

Amelanchier is widely distributed with many species through the temperate, northern

and mountainous regions of eastern and western North America; it occurs with one species in southern Europe, northern Africa and southwestern Asia, and with another in central and western China and Japan. Only three species, all North American, attain the habit and size of trees. The fruit of nearly all the species is more or less succulent, and several are cultivated in gardens for the beauty of their early and conspicuous flowers, and occasionally for their fruit. The name is of doubtful origin.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT SPECIES.

Leaves finely serrate, acute or acuminate at apex; flowers on elongated pedicels in nodding racemes; summit of the ovary glabrous; winter-buds lanceolate, long-acuminate.

Leaves densely white tomentose while young; flowers appearing before or as the leaves unfold in silky tomentose racemes; calyx-lobes ovate, acuminate or nearly triangular and acute; fruit dry and tasteless. **1. A. canadensis** (A).

Leaves slightly pubescent as they unfold, soon glabrous, dark red-brown while young; flowers appearing after the leaves are nearly half grown in glabrous racemes; calyx-lobes lanceolate or subulate, long-acuminate; fruit sweet and succulent. **2. A. laevis** (A).

Leaves coarsely serrate usually only above the middle, rounded at apex, oblong-ovate or oval; flowers on shorter pedicels in short erect or spreading racemes; summit of the ovary covered with hoary tomentum; winter-buds ovoid or ellipsoid, acute or short-acuminate. **3. A. florida** (F, C, G).

1. Amelanchier canadensis Med. Service Berry. Shad Bush.

Amelanchier canadensis var. *tomentula* Sarg.

Leaves ovate-oval, oblong-obovate or rarely lanceolate or oblanceolate, acuminate and often abruptly short-pointed at apex, rounded, slightly cordate or occasionally cuneate at base, and finely serrate with acuminate teeth pointing forward; thickly coated when

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they unfold with silvery white tomentum, more or less densely pale pubescent below until midsummer, later becoming glabrous or nearly glabrous, yellowish green on the upper surface, paler on the lower surface, usually 2′–4′ long and 1′–2′ wide, southward sometimes up to 6′ in length, with a slender midrib, and thin primary veins; petioles slender, hoary-tomentose at first, usually becoming glabrous by midsummer, $1\frac{1}{2}$′–2′ in

length. **Flowers** $\frac{1}{4}'$–$\frac{1}{3}'$ long, appearing in early spring before or as the leaves unfold, on pedicels $\frac{1}{4}'$–$\frac{1}{2}'$ in length, in short nodding silky tomentose racemes, their bracts and bractlets linear-lanceolate, villose, bright red; calyx-tube campanulate, glabrous or densely hoary-tomentose, the lobes ovate, acuminate or nearly triangular and acute, glabrous or hoary-tomentose on the outer surface, tomentose on the inner surface, reflexed after the petals fall; petals oblong-obovate, rounded or nearly truncate at apex, about $\frac{1}{6}'$ wide; summit of ovary glabrous. **Fruit** ripening in June and July, maroon-purple, dry and tasteless, about $\frac{1}{4}'$ in diameter.

A tree, occasionally 50°–70° high, with a trunk 12′–18′ in diameter, small erect and spreading branches forming a narrow round-topped head, and slender branchlets thickly covered when they first appear with long white hairs, soon glabrous, bright red-brown during their first year, becoming darker in their second season, and marked by numerous pale lenticels; usually smaller, and in the south Atlantic and Gulf states sometimes a shrub only a few feet tall. **Winter-buds** green tinged with brown, $\frac{1}{2}'$–$\frac{2}{3}'$ long, about $\frac{1}{12}'$ thick. **Bark** $\frac{1}{4}'$–$\frac{1}{2}'$ thick, dark ashy gray, divided by shallow fissures into longitudinal ridges covered by small persistent scales.

Distribution. At the north usually on dry exposed hills, on the borders of woods and in fence rows, southward often on the banks of streams and the borders of swamps; valley of the Penobscot River (Winn and Milford, Penobscot County) and Washington County (Pembroke, *M. L. Fernald*), Maine; Quebec (near Longueuil, *Bro. M. Victorin*); valley of the Connecticut River (central Vermont, southern New Hampshire, Massachusetts and Connecticut), and westward through western Massachusetts, New York, southern Ontario, southern Ohio, southern Michigan, and Indiana and Illinois; in central Iowa and southeastern Nebraska (Nemaha County, *J. M. Bates*), and southward to western Florida, southern Alabama, south central Mississippi, Louisiana westward to St. Landry Parish (near Opelousas, *R. S. Cocks*), Arkansas and northeastern Oklahoma; rare and of small size in the south Atlantic coast-region; ascending the southern Appalachian Mountains to altitudes of about 2200′, not common; abundant and probably of its largest size in western New York and southern Michigan.

Occasionally cultivated, and the first of all the cultivated species to flower in the spring.

2. Amelanchier laevis Wieg. Service Berry.

Amelanchier canadensis of many authors, in part, not L.

Leaves ovate to elliptic or rarely lanceolate, acute or acuminate and often abruptly short-pointed at apex, rounded and occasionally slightly cordate or rarely cuneate at base, and sharply and coarsely serrate with subulate callous-tipped teeth, covered when they unfold with long matted pale hairs more abundant on the lower surface than on the upper surface, soon glabrous, dark red-brown until nearly half grown, and at maturity dark green and slightly glaucous above, paler below, usually 2′–2½′ long and 1′–1½′ wide, rarely 3′–3½′ long and not more than 1′ wide, with a thin midrib and primary veins, rarely deep green and lustrous above (f. *nitida* Wieg.); petioles slender, slightly villose at first, soon glabrous, $\frac{1}{2}'$–1′ in length. **Flowers** $\frac{1}{2}'$–$\frac{3}{4}'$ long, appearing when the leaves are nearly half grown on pedicels $\frac{1}{2}'$–1′ in length, in open few-flowered nodding racemes, becoming much lengthened before the fruit ripens, their bracts and bractlets linear-lanceolate, slightly villose, tinged with rose color; calyx-tube campanulate, glabrous, the lobes lanceolate or subulate, long-acuminate, glabrous on the outer surface, tomentose on the inner surface, usually reflexed before the petals fall; petals oblong-obovate, rounded at apex, about $\frac{1}{6}'$ wide; summit of the ovary glabrous. **Fruit** ripening in June and July, obovoid to subglobose, usually rather broader than long, about $\frac{1}{3}'$ in diameter, purple or nearly black, glaucous, sweet and succulent, on pedicels often 1½′–2′ in length.

A tree, sometimes 30°–40° high, often with a tall trunk 12′–18′ in diameter, small spreading branches forming a narrow round-topped head, and slender glabrous branchlets reddish brown when they first appear, rather darker during their first winter and dull grayish

brown in their second season, and marked by small dark lenticels; at the north often a shrub sometimes only a few feet high. **Winter-buds** $\frac{1}{2}'$ long, about $\frac{1}{12}'$ thick, green tinged with red, the inner scales lanceolate, bright red above the middle, ciliate with silky white hairs, and sometimes 1′ long when fully grown. **Bark** $\frac{1}{4}'$–$\frac{1}{2}'$ thick, dark reddish brown, divided by shallow fissures into narrow longitudinal ridges and covered by small persistent scales. Wood heavy, exceedingly hard, strong, close-grained, dark brown sometimes tinged with red, with thick lighter-colored sapwood of 40–50 layers of annual growth; occasionally used for the handles of tools and other small implements.

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Distribution. Cool ravines and hillsides; Newfoundland, through the maritime provinces of Canada, Quebec and Ontario to northern Wisconsin, and southward through New England, New York and Pennsylvania, and along the Appalachian Mountains to northern Georgia; on the North Carolina Mountains ascending to altitudes of 5500°; common and generally distributed at the north and in New England, New York and through the Appalachian forests; the forma *nitida* only in Newfoundland.

Occasionally cultivated and very beautiful in spring with its abundant pure white flowers and conspicuous red-brown leaves.

3. Amelanchier florida Lindl. Service Berry.

Amelanchier alnifolia Sarg., probably not Nutt.
Amelanchier Cusickii Fern.

Leaves oblong-ovate to oval or ovate, or at the end of vigorous shoots broad-ovate or occasionally broad-obovate, rounded or rarely acute at apex, rounded or slightly cordate at base, and coarsely serrate only above the middle with straight teeth; when they unfold often tinged with red and sometimes floccose-pubescent below, usually soon glabrous, at maturity thin, dark green on the upper surface, pale and rarely pubescent on the lower surface, $1\frac{1}{2}'$–$2\frac{1}{2}'$ long, and 1′–$1\frac{1}{2}'$ wide, with a thin midrib and about ten pairs of primary veins; petioles slender, at first glabrous or puberulous becoming glabrous, $\frac{1}{2}'$–1′ in length. **Flowers** $\frac{1}{2}'$–$\frac{3}{4}'$ long, appearing when the leaves are about half grown on pedicels $\frac{1}{6}'$–$\frac{1}{4}'$ in length, in short crowded erect glabrous or pubescent racemes, their bracts and bractlets scarious, slightly villose; calyx-tube campanulate, glabrous or tomentose, the lobes ovate, long-acuminate, glabrous or tomentose on the outer surface, tomentose or rarely nearly glabrous on the inner surface, soon reflexed; petals oblong-obovate gradually narrowed or broad at the rounded apex, $\frac{1}{6}'$–$\frac{1}{4}'$ wide; summit of the ovary densely tomentose. **Fruit**

usually ripening in July, on pedicels $\frac{1}{2}'$–$\frac{3}{4}'$ long, in short nearly erect or spreading racemes, short-oblong or ovoid, dark blue, more or less covered with a glaucous bloom, $\frac{1}{4}'$ to nearly $\frac{1}{2}'$ in diameter, sweet and succulent.

A tree, occasionally 30°–40° high, with a tall trunk 12′–14′ in diameter, small erect and spreading branches forming an oblong open head, and slender branchlets glabrous, pubescent or puberulous when they first appear, bright red-brown and usually glabrous during their first season, rather darker in their second year, and ultimately dark gray-brown; more often a large or small shrub. **Winter-buds** ovoid to ellipsoidal, acute or acuminate,

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dark chestnut-brown, glabrous or puberulous, $\frac{1}{6}'$–$\frac{1}{4}'$ long, scales of the inner ranks ovate, acute, brightly colored, coated with pale silky hairs, $\frac{1}{2}'$–$\frac{3}{4}'$ long. **Bark** about $\frac{1}{8}'$ thick, smooth or slightly fissured, and light brown slightly tinged with red. **Wood** heavy, hard, close-grained, light brown. The nutritious fruit was an important article of food with the Indians of northwestern America, who formerly gathered and dried it in large quantities.

Distribution. Valley of the Yukon River (near Dawson) and Wrangell, Alaska, and southward to the coast region of British Columbia, and southward in Washington and Oregon possibly to northern California, ranging east in the United States to western Idaho, and probably to the northern Rocky Mountain region; its range, like that of the other species of western North America, still very imperfectly known.

7. CRATÆGUS. Hawthorn.

Trees or shrubs, with usually dark scaly bark, rigid terete more or less zigzag branchlets marked by oblong mostly pale lenticels, and by small horizontal slightly elevated leaf-scars, light green when they first appear, becoming red or orange-brown and lustrous or gray, rarely unarmed or armed with stout or slender short or elongated axillary simple or branched spines generally similar in color to that of the branches or trunk on which they grow, often bearing while young linear elongated caducous bracts, and usually producing at their base one or rarely two buds often developing the following year into a branch, a leaf, or a cluster of flowers, or sometimes lengthening into a leafy branch. Winter-buds small, globose or subglobose, covered by numerous imbricated scales, the outer rounded and obtuse at apex, bright chestnut-brown and lustrous, the inner accrescent, green or rose color, often glandular, soon deciduous. Leaves conduplicate in the bud, simple, generally serrate, sometimes 3-nerved, often more or less lobed, especially on vigorous leading branchlets, membranaceous to coriaceous, petiolate, deciduous; stipules often glandular-serrate, linear, acuminate, frequently bright-colored, deciduous, or on vigorous branchlets

often foliaceous, coarsely serrate, usually lunate and stalked and mostly persistent until autumn. Flowers pedicellate, in few or many-flowered simple or compound cymose corymbs terminal on short lateral leafy branchlets, with linear usually bright-colored often glandular caducous bracts and bractlets leaving prominent gland-like scars, the lower branches of compound corymbs usually from the axils of upper leaves; branches of the inflorescence mostly 3-flowered, the central flower opening before the others; calyx-tube usually obconic, 5-lobed, the lobes acute or acuminate and usually gland-tipped, rarely foliaceous, glandular-serrate or entire, green or reddish toward the apex, reflexed after the flowers open, persistent and often enlarged on the fruit, or deciduous; disk thin or fleshy, entire, lobed or slightly sulcate, concave or somewhat convex; petals imbricated in the bud, orbicular, entire or somewhat erose or rarely toothed at apex, white or rarely rose color, spreading, soon deciduous; stamens often variable in number in the same species by imperfect development, but normally 5 in 1 row and alternate with the petals, or 10 in 5 pairs in 1 row alternate with the petals, or 15 in 2 rows, those of the outer row in 5 pairs opposite the sepals and alternate with and rather longer than those of the inner row, or 20 in 3 rows, those of the inner row shorter and alternate with those of the 2d row, or 25 in 4 rows, those of the 4th row alternate with those of the 3d row; filaments broad at base, subulate, incurved, often persistent on the fruit; anthers pale yellow to nearly white, or pink to light or dark rose color or purple; ovary composed of 1–5 carpels inserted in the bottom of the calyx-tube and united with it; styles free, with dilated truncate stigmas, persistent on the mature carpels; ovules ascending; raphe dorsal; micropyle inferior. Fruit subglobose, ovoid or short-oblong, scarlet, orange-colored, red, yellow, blue, or black, generally open and concave at apex; flesh usually dry and mealy; nutlets 1–5; united below, more or less free and slightly spreading above the middle, thick-walled, rounded, acute, or acuminate at apex, full and rounded or narrowed at base, rounded or conspicuously ridged and grooved on the back, flattened, or nearly round when only 1, their ventral faces plane or plano-convex, in some species penetrated by longitudinal cavities or hollows, and marked by a more or less conspicuous hypostyle sometimes extending to below the middle or nearly to the base of the nutlet. Seed solitary by abortion, erect, compressed, acute, with a membranaceous light chestnut-brown coat; embryo filling the cavity of the seed; cotyledons plano-convex, radicle short, inferior.

Cratægus is most abundant in eastern North America, where it is distributed from Newfoundland to the mountains of northern Mexico, and is represented by a large number of arborescent and shrubby species. A few species occur in the Rocky Mountains and Pacific-coast regions, and in China, Japan, Siberia, central and southwestern Asia, and in Europe. The genus is still very imperfectly known in North America, and in the absence of sufficient information concerning them several arborescent species are necessarily excluded from the following enumeration. The beautiful and abundant flowers and showy fruits make many of the species desirable ornaments of parks and gardens, and several are cultivated. Of exotic species, the Old World *Cratægus Oxyacantha* L., and *C. monogyna* Jacq., early introduced into the United States as hedge plants, have now become naturalized in many places in the northeastern and middle states. Cratægus produces heavy hard tough close-grained red-brown heartwood and thick lighter colored usually pale sapwood; useful for the handles of tools, mallets, and other small articles.

The number of the stamens, although it differs on the same species within certain usually constant limits, and the color of the anthers, which appears to be specifically constant with one exception, afford the most satisfactory characters for distinguishing the species in the different groups.

Cratægus, from κράτος, is in reference to the strength of the wood of these trees.

CONSPECTUS OF THE NATURAL GROUPS OF THE NORTH AMERICAN ARBORESCENT SPECIES.

1. Nutlets without ventral cavities.
*Veins of the leaves extending to the points of the lobes only.
−+Petioles short, usually slightly wing-margined above the middle, glandless or with occasional minute glands; leaves cuneate at base.
Corymbs compound, generally many-flowered; flowers appearing after the unfolding of the leaves; flesh of the fruit usually green or greenish yellow, dry and mealy.
Leaves coriaceous or subcoriaceous, rarely thin, dark green and shining above, usually serrate only above the middle, their veins thin except on vigorous shoots; fruit mostly subglobose to short-oblong; nutlets 1–5, thick, usually obtuse and rounded at the ends, prominently ridged on the back.
I. **Crus-galli** (page 400).
Leaves membranaceous or subcoriaceous, mostly acute, their veins prominent; fruit short-oblong to subglobose, often conspicuously punctate, $\frac{1}{3}'$–$1'$ long; nutlets 2–5, prominently ridged on the back. II. **Punctatæ** (page 422).
Corymbs simple, few-flowered; flowers appearing with or before the unfolding of the leaves; fruit scarlet, lustrous; flesh yellow, juicy, subacid; nutlets rounded and slightly grooved on the back. III. **Æstivales** (page 434).
−+Petioles elongated, slender, eglandular or occasionally glandular; corymbs many-flowered (*few-flowered in one species each of Dilatatæ and Intricatæ*).
++Leaves acute or acuminate at the ends, broad at base on one species; fruit not more than $\frac{5}{8}'$ in diameter; flesh usually thin and dry. IV. **Virides** (page 437).
++Leaves usually broad at base.
Fruit subglobose to short-oblong, often broader than high, red or green, often slightly 5-angled, pruinose; mature calyx raised on a short tube; flesh of the fruit dry and mealy; nutlets 5, grooved on the back. V. **Pruinosæ** (page 449).
Fruit subglobose to short-oblong, ovoid or obovoid, generally longer than broad, rarely slightly pruinose, mature calyx sessile; flesh of the fruit dry and mealy; stamens 10, anthers rose color; leaves hairy above early in the season.
VI. **Silvicolæ** (page 453).
Fruit short-oblong to obovoid, red or scarlet; flesh of the fruit usually soft and juicy; anthers rose color or pink; leaves thin, at maturity glabrous below.
VII. **Tenuifoliæ** (page 456).
Fruit subglobose, oblong or obovoid, crimson, scarlet, or rarely yellow; flesh thick, occasionally succulent, and edible; nutlets usually 5, thin, pointed at the ends, mostly obscurely grooved or ridged on the back; corymbs tomentose or pubescent; leaves membranaceous to subcoriaceous, broad, rounded or cuneate at base, at maturity usually pubescent or tomentose below.
VIII. **Molles** (page 463).
Fruit short-oblong to obovoid, scarlet; flesh usually soft and juicy; nutlets 3–5, grooved and usually ridged on the back; corymbs glabrous or tomentose; leaves thin or rarely subcoriaceous, oblong-ovate or oval, more or less acutely lobed; anthers rose or purple; rarely white in shrubby species.
IX. **Coccineæ** (page 488).
Fruit subglobose to short-oblong, crimson, or red tinged with green, its calyx enlarged and prominent; nutlets 5; stamens 20; anthers rose color; leaves thin, at the end of vigorous shoots as broad or broader than long.
X. **Dilatatæ** (page 500).
++Leaves cuneate at base.
Corymbs many-flowered; leaves subcoriaceous; fruit subglobose, rarely short-oblong; nutlets 2 or 3, obtuse at the ends, conspicuously ridged on the back; corymbs glabrous or tomentose; leaves dark green and lustrous above.
XI. **Rotundifoliæ** (page 504).

Corymbs few-flowered (*many-flowered in one species of Bracteatæ*).

Fruit subglobose to short-oblong, greenish or yellowish; nutlets 3–5, usually rounded at the ends, conspicuously ridged on the back; leaves subcoriaceous, yellow-green. XII. **Intricatæ** (page 508).

Fruit subglobose, red or orange-red; nutlets 3–5, slightly grooved on the back; stamens 20; anthers rose color; leaves thin, incisely lobed. XIII. **Pulcherrimæ** (page 511).

Fruit subglobose to short-oblong, $\frac{1}{2}'$–$\frac{5}{8}'$ long; nutlets 3–5, narrowed at the ends, prominently ridged on the back; corymbs villose; bracts large and conspicuous; calyx-lobes foliaceous; stamens 20; anthers yellow; leaves dark green, lustrous and scabrate above, their petioles sparingly glandular through their whole length. XIV. **Bracteatæ** (page 513).

++Petioles long or short, leaves and corymbs glandular; corymbs usually simple, few-flowered; fruit subglobose to short-oblong or obovoid, green, orange, or red, flesh usually hard and dry; branchlets conspicuously zigzag. XV. **Flavæ** (page 515).

**Veins of the leaves extending to the points of the lobes and to the sinuses; corymbs many-flowered; stamens usually 20.

Fruit depressed-globose to short-oblong, not more than $\frac{1}{4}'$ long, scarlet; nutlets 2–5, prominently ridged and often grooved on the back; anthers rose color or yellow. XVI. **Microcarpæ** (page 530).

Fruit subglobose, $\frac{1}{3}'$–$\frac{1}{2}'$ in diameter, blue or blue-black; nutlets 3–5, obtuse at the ends, slightly ridged on the back; anthers yellow; leaves cuneate at base, dark green and lustrous. XVII. **Brachyacanthæ** (page 533).

2. Nutlets with longitudinal cavities on their ventral faces; flowers in many flowered compound corymbs.

Fruit obovoid to subglobose or short-oblong, lustrous, orange or scarlet; nutlets 2 or 3, obtuse at the ends, prominently ridged on the back; leaves thin to subcoriaceous, mostly pubescent below. XVIII. **Macracanthæ** (page 535).

Fruit short-oblong to subglobose, black; rarely chestnut color; nutlets 5, obtuse at the ends, obscurely ridged on the back; stamens 10–20; anthers pale rose color. XIX. **Douglasianæ** (page 545).

Fruit subglobose, short-oblong to ovoid, scarlet; nutlets 3–5, acute at the ends, ridged on the back, ventral cavities obscure; leaves scabrate above. XX. **Anomalæ** (page 547).

I. CRUS-GALLI.

CONSPECTUS OF THE ARBORESCENT SPECIES.

Corymbs, leaves, and young branchlets slightly hairy while young, soon becoming glabrous (*glabrous while young in* 1, 4, 6, 9, *and* 13).

Stamens 10.

Anthers rose color or purple.

Leaves glabrous, obovate-cuneiform, coriaceous, their veins within the parenchyma; fruit short-oblong to subglobose, dull red often covered with a glaucous bloom. 1. **C. Crus-galli** (A).

Leaves oblong to ovate, usually acute, coriaceous; fruit short-oblong to subglobose, dark crimson, lustrous, the flesh red and juicy. 2. **C. Canbyi** (A).

Leaves obovate, usually short-pointed at the broad apex, subcoriaceous; fruit short-oblong to obovoid, bright scarlet. 3. **C. peoriensis** (A).

Leaves oblong-obovate to oval, or broadly ovate, their petioles glandular with minute stipitate glands; fruit short-oblong to subglobose, orange-red, villose until nearly fully grown. 4. **C. fecunda** (A).

Anthers yellow.

Leaves subcoriaceous.

Leaves oval to elliptic, acute or acuminate; fruit short-oblong, green tinged with red. 5. **C. regalis** (C).

Leaves glabrous, obovate, acute, acuminate, or rounded at apex; fruit short-oblong, dull dark crimson. 6. **C. arduennæ** (A).

Leaves obovate to oblong-cuneiform, rounded or acute at apex; fruit subglobose to obovoid, dull red, or green flushed with red. 7. **C. algens** (A, C).

Leaves broadly oval to oblong, rounded or acute or short-pointed at apex; fruit subglobose, dull green tinged with red or cherry-red. 8. **C. Palmeri** (C).

Leaves thin.

Leaves ovate to obovate, acute, dull green above; fruit subglobose, flattened at the ends, dark dull crimson. 9. **C. erecta** (A).

Leaves oval to oblong-obovate, acute or acuminate, lustrous above; fruit short-oblong, rounded at the ends, bright scarlet. 10. **C. acutifolia** (A).

Stamens 20.

Anthers rose color.

Leaves broad-obovate, coarsely serrate; corymbs many-flowered; anthers large, bright rose color; fruit green tinged with dull red. 11. **C. Bushii** (C).

Leaves narrow-obovate, finely serrate; corymbs few-flowered; anthers small pale rose color; fruit crimson, lustrous. 12. **C. Cocksii** (C).

Anthers yellow.

Leaves oblong-obovate to oblanceolate; calyx-lobes slender, elongated. 13. **C. arborea** (C).

Leaves oblong-obovate; calyx-lobes short and broad. 14. **C. uniqua** (C).

Corymbs, leaves, and branchlets more or less villose or pubescent through the season.

Stamens 10.

Anthers rose color or pink.

Leaves finely crenately serrate, scabrate above; anthers rose color. 15. **C. Engelmannii** (A).

Leaves coarsely serrate with straight teeth, glabrous above; anthers pink. 16. **C. montivaga** (C).

Anthers yellow (*doubtful in* 17 *and* 18).

Leaves oval, oblong-obovate or elliptic, acute, thin to subcoriaceous; fruit globose to subglobose, orange-red. 17. **C. denaria** (C).

Leaves obovate to obovate-cuneiform, rounded or acute at apex, thin; fruit short-oblong, dark red, more or less pruinose. 18. **C. signata** (C).

Stamens 20.

Anthers rose color.

Leaves oblong-obovate, acute, scabrate; fruit short-oblong, dull green tinged with red, slightly pruinose. 19. **C. edita** (C).

Leaves oblong to obovate-cuneiform, rounded and obtuse or occasionally acute at apex, glabrous or scabrate above; fruit globose to subglobose or short-oblong, dark red. 20. **C. tersa** (C).

Anthers yellow.

Leaves oblong-obovate, rounded or gradually narrowed at apex, subcoriaceous, pale below; fruit subglobose, orange color with a red cheek. 21. **C. berberifolia** (C).

Leaves oblong or obovate-cuneiform, rounded and obtuse or rarely acute at apex, coriaceous, glabrate or slightly scabrate above; fruit subglobose, orange or yellow with a red cheek. 22. **C. edura** (C).

Leaves oblong to obovate-cuneiform, rounded or acute at apex, subcoriaceous, glabrous or glabrate above, pale below; fruit ellipsoid to short-oblong, yellow. 23. **C. crocina** (C).

Leaves oblong to obovate-cuneiform, rounded or obtuse or rarely truncate at apex, coriaceous, scabrate above; fruit globose to subglobose, bright red or scarlet. 24. **C. fera** (C).

Leaves obovate, acute, thin to subcoriaceous; fruit subglobose to short-oblong, somewhat flattened at apex, bright orange-red. 25. **C. Mohrii** (C).

1. Cratægus Crus-galli L. Cock-spur Thorn.

Leaves glabrous, obovate, acute or rounded at apex, cuneate and gradually narrowed to the slender entire base, and sharply serrate above with minute appressed usually gland-tipped teeth, when they unfold tinged with red, membranaceous and nearly fully grown when the flowers open about the 1st of June, and at maturity thick and coriaceous, dark green and lustrous above, pale below, reticulate-venulose, 1′–4′ long, and ¼′–1′ wide, with a slender midrib, and primary veins within the parenchyma; turning bright orange and scarlet in the autumn before falling; petioles stout, ½′–¾′ in length; leaves at the end of vigorous shoots acute or acuminate, coarsely serrate, often 5′–6′ long. **Flowers** ⅔′ in diameter, on slender pedicels, in many-flowered glabrous corymbs; calyx-tube narrowly obconic, glabrous, the lobes linear-lanceolate, entire or minutely glandular-serrate; stamens 10; anthers rose color; styles usually 2, surrounded at base by tufts of pale hairs. **Fruit**

Fig. 353

ripening late in October and persistent on the branches until spring, short-oblong to subglobose, ½′ long, dull red often covered with a glaucous bloom; calyx little enlarged; nutlets usually 2, full and rounded at the ends, with a high rounded grooved ridge, ¼′ long.

A tree, sometimes 25° high, with a trunk a foot in diameter, covered with dark brown, scaly bark, stout rigid spreading branches forming a broad round-topped head, and glabrous, light brown or gray branchlets armed with stout straight or slightly curved sharp-pointed chestnut-brown or ashy gray spines 3′–4′ long and becoming on the trunk and large branches 6′–8′ in length and furnished with slender lateral spines.

Distribution. Usually on the slopes of low hills in rich soil; valley of the St. Lawrence River near Montreal, southward to Delaware and along the Appalachian foothills to North Carolina, and westward through western New York and Pennsylvania to southern Michigan, and southern Illinois.

A form, var. *pyracanthifolia* Ait., with narrower elliptic to obovate leaves acute or rounded at apex, and slightly pubescent while young on the upper side of the midrib, and with rather smaller flowers and smaller bright red fruit, is not rare in eastern Pennsylvania and northern Delaware; a form, var. *salicifolia* Ait., cultivated in European gardens, but not known in a wild state, with thinner narrower and more elongated lanceolate or oblanceolate leaves, should also probably be referred to this species. A form, var. *oblongata* Sarg., with rather brighter colored oblong fruit often 1′ long, and nutlets acute at the ends, is not rare near Wilmington, Delaware, and at Durham, Bucks County, Pennsylvania. A form, var. *capillata* Sarg., with thinner leaves, slightly villose corymbs, and 1 or rarely 2 nutlets, occurs near Wilmington, Delaware.

Often cultivated as an ornamental plant and for hedges in the eastern United States, and very frequently in the countries of eastern and northern Europe.

2. Cratægus Canbyi Sarg.

Leaves oblong-ovate to ovate, obovate or oval, acute, acuminate or rarely rounded at apex, gradually narrowed, cuneate and entire at base, and coarsely often doubly serrate above the middle, more than half grown when the flowers open about the 1st of May and then glabrous or very rarely with a few scattered hairs on the upper side of the midrib and on the corymbs, and at maturity coriaceous, glabrous, dark green and very lustrous above, pale and dull below, 2′–2½′ long, and 1′–1½′ wide, with a thick pale midrib, and 4 or 5 pairs of remote primary veins conspicuous on the lower surface; petioles glandular with scattered

Fig. 354

dark red persistent glands, red below the middle, ½′–¾′ in length; leaves at the end of vigorous shoots often deeply and irregularly divided into broad acute lobes, and frequently 3′–4′ long and 2′ wide. **Flowers** ⅝′ in diameter, on long slender pedicels, in broad loose many-flowered long-branched corymbs; calyx-tube narrowly obconic, the lobes entire, or serrate with minute scattered glandular teeth; stamens usually 10, occasionally 12 or 13; anthers, small, rose color; styles 3–5. **Fruit** ripening in October but persistent until after the beginning of winter, on elongated slender stems, in loose many-fruited drooping clusters, short-oblong to subglobose, rounded at the ends, with a distinct depresssion at the insertion of the stalk, lustrous, dark crimson, marked by occasional large pale dots, ½′–⅝′ long; calyx-lobes reflexed, closely appressed, often deciduous before the fruit ripens; flesh thick, bright red, very juicy; nutlets 3–5, with a broad rounded ridge, bright chestnut-brown, about ¼′ long.

A bushy tree, sometimes 20° high, with a trunk 12′–18′ in diameter, large ascending wide-spreading branches forming a broad open irregular head occasionally 30°–35° in diameter, and glabrous chestnut-brown branchlets armed with thick usually straight chestnut-brown spines ¾′–1½′ long.

Distribution. Hedges and thickets near Wilmington, Newcastle County, Delaware; shores of Chesapeake Bay (near Perryville, Cecil County), Maryland, and in eastern Pennsylvania.

3. Cratægus peoriensis Sarg.

Leaves obovate, short-pointed or occasionally rounded at the broad apex, gradually narrowed, cuneate and entire below, sharply and often doubly serrate usually only above the middle, and sometimes irregularly lobed with short broad terminal lobes, when they unfold

villose above, especially toward the base of the midrib, and bright bronze color, becoming at maturity thick and firm, glabrous, dark green and very lustrous above, pale below, 1½′–2′ long, and ¾′ wide, with 4 or 5 pairs of thin primary veins conspicuous on the under side and extending obliquely from the slender midrib to the end of the lobes; petioles usually about ¼′ in length, slightly glandular above the middle, and covered when they first appear with short pale deciduous hairs; leaves at the end of vigorous shoots deeply divided into broad acute lateral lobes, 2′–3′ long, and 1½′ wide. **Flowers** opening in May and June, cup-shaped, about ½′ in diameter, on slender elongated pedicels, in broad loose glabrous corymbs; calyx-tube narrowly obconic, the lobes narrow acuminate, entire or irregularly glandular-serrate, pubescent below the middle on the inner surface; stamens 10; anthers

Fig. 355

small, rose color; styles 2 or 3, surrounded at base by a narrow ring of pale tomentum. **Fruit** ripening early in October, on slender elongated pedicels, in drooping many-fruited clusters, short-oblong or obovoid, rounded at the ends, slightly depressed at the insertion of the stalk, bright scarlet, marked by many small dark dots, ½′–¾′ long; calyx-lobes enlarged, erect, incurved and persistent; flesh thick, nearly white, firm and dry; nutlets 2 or 3, about ¼′ long.

A tree, 20°–25° high, with a trunk occasionally 1° in diameter, stout spreading branches forming a broad flat-topped symmetrical head, and slender orange-brown branchlets armed with straight or slightly curved thin dull chestnut-brown spines 2′–2½′ long.

Distribution. Open woods, the moist borders of streams and depressions in the prairie, and on hillsides in clay soil, Short and Peoria Counties, Illinois.

4. Cratægus fecunda Sarg.

Leaves oblong-obovate to oval, or broad-ovate, acute or rarely rounded and short-pointed at apex, gradually or abruptly narrowed at base, and coarsely and usually doubly serrate except toward the base, when they unfold dark green, lustrous and roughened above by short pale appressed caducous hairs and pale yellow-green and villose on the midrib and primary veins below, about half grown when the flowers open early in May and at maturity thin and firm in texture, dark green and lustrous on the upper surface, pale yellow-green on the lower surface, 2′–2½′ long, and 1½′–2′ wide, with a stout midrib and remote primary veins after midsummer often bright red below; turning late in the autumn to brilliant shades of orange or scarlet or deep rich bronze color; petioles often glandular, at first coated with pale hairs, soon glabrous, dull red at maturity, ½′–¾′ in length; leaves at the end of vigorous shoots often slightly lobed with short broad acute lobes, convex by the hanging down of the margins, 3′–4′ long, and 2′–3′ wide. **Flowers** ¾′ in diameter, on slender pedicels, in wide many-flowered slightly villose corymbs, with large glandular bracts and bractlets; calyx-

tube narrowly obconic, more or less villose, the lobes elongated, acute, coarsely serrate with stipitate dark red glands, villose on the inner surface; stamens usually 10, occasionally 12–15; anthers small, dark rose color; styles 2 or 3. **Fruit** on slender pedicels often $\frac{1}{2}'$ long,

Fig. 356

in broad many-fruited drooping clusters, short-oblong to subglobose, full and rounded at the ends, covered until nearly fully grown with long soft pale hairs, and at maturity orange-red marked by many small dark dots, $\frac{7}{8}'$–$1'$ long; calyx-lobes linear-lanceolate, erect and incurved, coarsely glandular-serrate above the middle, dark red on the upper side toward the base; flesh very thick, firm and hard, pale green; nutlets 2 or 3, $\frac{1}{3}'$ long.

A tree, 20°–25° high, with a trunk 10′–12′ in diameter, covered with dark brown scaly bark, stout wide-spreading branches forming a broad symmetrical round-topped rather open head, and stout branchlets covered at first with soft matted pale hairs, soon glabrous, light orange-green, becoming ashy gray in their second season, and armed with numerous very slender straight or slightly curved chestnut-brown shining spines $2'$–$2\frac{1}{2}'$ long.

Distribution. Rich woodlands near Allenton, St. Louis County, Missouri, and on the bottom-lands of the Mississippi River, Clair County, Illinois.

5. Cratægus regalis Beadl.

Leaves oval to elliptic, acute or acuminate at apex, gradually narrowed and concave-cuneate at the entire base, and coarsely, often doubly serrate above with acute straight or

Fig. 357

incurved teeth, when they unfold tinged with red and sparingly villose above and on the midrib below, soon glabrous, nearly fully grown when the flowers open at the end of April, becoming at maturity thick and firm or subcoriaceous, bright green and lustrous on the upper surface, pale on the lower surface, $1\frac{1}{2}'$–$2\frac{1}{2}'$ long, and $1'$–$1\frac{1}{4}'$ wide, with a stout yellow midrib and primary veins; turning in the autumn yellow, orange, and brown; petioles stout, reddish brown toward the base, about $1'$ in length; leaves at the end of vigorous shoots broadly oval, coarsely serrate, mostly slightly incisely lobed, $3'$–$4'$ long, and $1\frac{1}{2}'$–$2'$ wide, with a thicker midrib and veins. **Flowers** $\frac{1}{2}'$ in diameter, on long slender pedicels, in broad many-flowered corymbs; calyx-tube narrowly obconic, the lobes linear-lanceolate, entire or remotely serrate; stamens 10; anthers yellow; styles 2 or 3. **Fruit** ripening in September or October, on slender stems, in few-fruited drooping clusters, short-oblong, $\frac{3}{8}'$–$\frac{1}{2}'$ long, green tinged with red; calyx-lobes slightly enlarged, reflexed and often deciduous from the ripe fruit; flesh yellow, dry and mealy; nutlets 2 or 3, about $\frac{1}{4}'$ long.

A tree, often 20° high, with a tall trunk $8'$–$12'$ in diameter, stout ascending or spreading branches forming a broad symmetrical head, and stout glabrous orange-brown branchlets armed with stout or slender nearly straight spines $1\frac{1}{2}'$–$2'$ long.

Distribution. Low woods, northwestern Georgia and northern Alabama; common in the flat woods near Rome, Floyd County, Georgia.

6. Cratægus arduennæ Sarg.

Leaves obovate, acute, acuminate or rounded at apex, gradually narrowed from near the middle to the entire cuneate base, and finely crenulate-serrate above with glandular teeth,

Fig. 358

glabrous and deeply tinged with red as they unfold, nearly fully grown when the flowers open at the end of May or early in June, and at maturity subcoriaceous, dark green and very lustrous above, pale below, $1\frac{1}{2}'$–$2\frac{1}{2}'$ long, and $\frac{1}{2}'$–$1'$ wide, with a slender yellow midrib, and obscure primary veins mostly within the parenchyma; petioles stout, occasionally sparingly glandular, $\frac{1}{4}'$–$\frac{5}{8}'$ in length; leaves at the end of vigorous shoots mostly elliptic, short-pointed, coarsely serrate, usually laterally lobed, and often $2\frac{1}{2}'$–$3'$ long, and $1\frac{1}{2}'$–$2'$ wide, with a stout midrib and prominent slender primary veins. **Flowers** $\frac{1}{2}'$–$\frac{3}{8}'$ in diameter, on long slender pedicels, in broad many-flowered glabrous corymbs; calyx-tube narrowly obconic, the lobes abruptly narrowed from the base, linear, acuminate, tipped with small dark red glands, entire or slightly and irregularly serrate; stamens 5–12; usually 10; anthers small, pale yellow; styles 1 or 2. **Fruit** on slender pedicels, in drooping many-fruited clusters, short-oblong, dull dark crimson, marked by large pale dots, about $\frac{1}{2}'$ long, and $\frac{3}{8}'$–$\frac{1}{2}'$ in diameter; calyx only slightly enlarged, the lobes reflexed and appressed; flesh thin and

yellow; nutlet 1, gradually narrowed from the middle to the obtuse ends, grooved and irregularly ridged on the dorsal face, or 2 and then broad, rounded at the ends, with a high wide rounded ridge, about $\frac{5}{16}'$ long.

A tree, sometimes 20° high, with a trunk 8′–12′ in diameter, covered with smooth light gray bark, spreading branches forming a round-topped head, and slender slightly zigzag branchlets light orange-green when the first appear, becoming dark purple and lustrous and ultimately grayish brown, and armed with many slender straight or slightly curved dark purple-brown shining spines 1′–2′ long.

Distribution. Central and northern Missouri, northern Illinois, northeastern Indiana (Allen County), southeastern Michigan, southern Ontario, through Ohio to western New York (South Buffalo, Erie County), and in eastern Pennsylvania (Berks County).

7. Cratægus algens Beadl.

Leaves obovate to oblong or elliptic, rounded or acute at apex, gradually narrowed and concave-cuneate at the entire base, sharply serrate above, villose on the upper side of the

Fig. 359

midrib and nearly full grown when the flowers open at the end of May, and at maturity glabrous, subcoriaceous, dark green and lustrous above, pale below, $1\frac{1}{2}'$–2′ long, and $\frac{3}{4}'$–$1\frac{1}{4}'$ wide, with a thin midrib and slender primary veins; turning in the autumn to shades of orange, yellow, and brown; petioles slender, rarely glandular with minute glands, about $\frac{1}{4}'$ in length; leaves at the end of vigorous shoots oblong-obovate, rounded or abruptly short-pointed at apex, coarsely serrate, and often 3′ long and $1\frac{1}{2}'$ wide. **Flowers** $\frac{1}{2}'$ in diameter, on slender elongated pedicels, in broad many-flowered glabrous corymbs; calyx-tube narrowly obconic, glabrous, the lobes slender, acuminate, entire or remotely serrate; stamens 10; anthers yellow; styles 1–3. **Fruit** ripening in September and October, on slender pedicels, in few-fruited hanging clusters, subglobose to obovoid, $\frac{3}{8}'$–$\frac{1}{2}'$ in diameter, dull red, or green flushed with red, $\frac{3}{8}'$–$\frac{1}{2}'$ long; calyx somewhat enlarged, with reflexed persistent lobes; nutlets usually 1 or 2, prominently ridged on the back, $\frac{1}{4}'$–$\frac{3}{8}'$ long.

A tree, 15°–18° high, with a short trunk occasionally 7′–8′ in diameter, stout ascending wide-spreading branches forming a wide round-topped head, and stout glabrous bright chestnut-brown branchlets becoming gray in their second year, and armed with stout nearly straight spines 1′–2′ long.

Distribution. Borders of woods and fields; western North Carolina to northern Georgia and central Alabama (near Selma, Dallas County, common), and to eastern Tennessee; one of the commonest species in the neighborhood of Asheville, Buncombe County, North Carolina.

8. Cratægus Palmeri Sarg.

Leaves broadly oval to oblong, rounded, acute or short-pointed at apex, gradually narrowed and cuneate at the entire base, and coarsely serrate above with straight gland-tipped teeth, nearly fully grown when the flowers open during the first week in May, and then very thin, dark green and lustrous above, pale bluish green below, and at maturity coriaceous, dark green and lustrous on the upper surface, paler on the lower surface, $1\frac{1}{2}'$–$2'$ long, and $1\frac{1}{4}'$–$1\frac{3}{4}'$ wide, with a slender yellow midrib and 4 or 5 pairs of very thin primary veins; petioles stout, rose-colored in the autumn, about $\frac{3}{8}'$ in length; leaves at the end of vigorous shoots

Fig. 360

oblong-ovate to elliptic, usually acute, coarsely serrate, occasionally laterally lobed, glandular at base, $2\frac{1}{2}'$–$3'$ long, and $1\frac{1}{2}'$–$2'$ wide. **Flowers** about $\frac{1}{2}'$ in diameter, on slender pedicels, in many-flowered corymbs; calyx-tube narrowly obconic, the lobes slender, acuminate, tipped with small dark glands, entire or slightly serrate; stamens 10; anthers pale yellow; styles 3, surrounded at base by a thin ring of pale tomentum. **Fruit** ripening in October, on slender elongated pedicels, in few-fruited drooping clusters, subglobose, dull green tinged with red or cherry-red, marked by large pale dots, about $\frac{1}{3}'$ in diameter; calyx sessile, with erect and incurved lobes mostly persistent on the ripe fruit; nutlets 3, thin, acute at the ends, slightly and irregularly ridged on the back with a low grooved ridge, $\frac{1}{4}'$–$\frac{5}{16}'$ long.

A tree, sometimes 25° high, with a trunk often a foot in diameter, covered with smooth pale bark, stout wide-spreading branches forming a broad round-topped symmetrical head, and slender nearly straight glabrous, bright chestnut-brown branchlets armed with thin straight dark red-brown shining spines $\frac{3}{4}'$–$3'$ long.

Distribution. Southwestern Missouri, usually in low rich soil; common near Carthage and Webb City, Jasper County, and near Noel, McDonald County, to southeastern Kansas and northwestern Arkansas.

9. Cratægus erecta Sarg.

Leaves oval to obovate, acute and short-pointed at apex, cuneate and entire at base, and finely glandular-serrate, when they unfold often villose with a few short caducous pale hairs on the upper side of the midrib, nearly fully grown when the flowers open early in May, and at maturity thin and firm in texture, dark dull green on the upper surface, pale on the lower surface, $1\frac{1}{2}'$–$2'$ long, and $1'$–$1\frac{1}{4}'$ wide, with a slender midrib, and thin prominent primary veins; in the autumn turning dull orange color; petioles slender, glandular with minute dark glands, usually dark red after midsummer, $\frac{1}{4}'$–$\frac{1}{2}'$ in length; leaves at the end of vigorous shoots often nearly orbicular, coarsely serrate with broad nearly straight glandular teeth, and sometimes $3'$ long and $2\frac{1}{2}'$ wide. **Flowers** $\frac{1}{2}'$–$\frac{5}{8}'$ in diameter, on slender

pedicels, in broad loose many-flowered glabrous corymbs; calyx-tube narrowly obconic, the lobes narrow, elongated, acuminate, entire or occasionally obscurely and irregularly serrate; stamens usually 10, occasionally 11–13; anthers small, pale yellow; styles 3 or 4, surrounded at base by a narrow ring of short pale hairs. **Fruit** on elongated pedicels, in few-fruited drooping clusters, subglobose and usually a little longer than broad, flattened at the ends, dark dull crimson marked by occasional dark-colored dots, $\frac{1}{4}'$–$\frac{1}{3}'$ long; calyx-tube short, the lobes closely appressed, gradually narrowed from a broad base and usually persistent on the ripe fruit; nutlets 3 or 4, with a broad high grooved ridge, $\frac{3}{16}'$ long.

Fig. 361

A tree, 25°–40° high, with a trunk 1°–3° in diameter, thick ascending branches forming a wide open rather symmetrical head, and bright chestnut-brown or orange-brown ultimately dark brown spreading branchlets armed with thin straight chestnut-brown spines 1′–2′ long.

Distribution. Rich bottom-lands of the Mississippi River, St. Clair County (East St. Louis, near Fish Lake, and Cahokia) to Richland County, and southern Illinois and southern Indiana; banks of Desperes River, south St. Louis, St. Louis County, and Osage, Cole County, Missouri, and western and southwestern Arkansas.

10. Cratægus acutifolia Sarg.

Leaves oval to oblong-obovate, acute or acuminate or rarely rounded at apex, cuneate at the usually entire base, finely crenulate-serrate often only above the middle with glandular teeth, nearly fully grown when the flowers open about the 10th of May, and then membranaceous, and lustrous above, with occasional short scattered pale caducous hairs on the upper side of the midrib, and at maturity thin and firm, dark green and lustrous above, pale yellow-green below, about $1\frac{1}{2}'$ long, and 1′ wide, with a slender light yellow midrib and about 4 or 5 pairs of thin primary veins: petioles glandular when they first appear with minute dark glands, $\frac{1}{4}'$–$\frac{1}{2}'$ in length; leaves at the end of vigorous shoots frequently divided at apex into 2 or 3 pairs of short acute lobes, and often 3′ long and 2′ wide. **Flowers** $\frac{1}{2}'$ in diameter, on slender pedicels, in many-flowered compact corymbs; calyx-tube narrowly obconic, the lobes lanceolate, acuminate, entire or obscurely and irregularly glandular-serrate; stamens 10; anthers small, pale yellow; styles 2 or 3. **Fruit** ripening and falling at the end of September, on slender pedicels $\frac{1}{2}'$–$\frac{3}{4}'$ long, in few-fruited drooping clusters, short-oblong, full and rounded at the ends, bright scarlet, marked by occasional dark dots, $\frac{1}{2}'$ long; calyx-tube prominent, with closely appressed lobes often deciduous before the fruit ripens; nutlets 2 or 3, with a broad rounded ridge, about $\frac{3}{16}'$ long.

A tree, often 30° high, with a trunk 18′ in diameter, stout wide-spreading branches forming a symmetrical round-topped rather open head, and stout bright chestnut-brown

Fig. 362

branchlets dark gray-brown in their second year, and occasionally armed with scattered thin straight chestnut-brown spines 1′–2′ long.

Distribution. Open woods; banks of the Desperes River near Carondelet, St. Louis County, Missouri; in St. Clair County (north of stock yards, East St. Louis, and near Cahokia), and in Richland County, Illinois, western Tennessee and to the neighborhood of Fayetteville, Arkansas.

11. Cratægus Bushii Sarg.

Leaves obovate, broad and rounded or acute at apex, or elliptic and acute, gradually narrowed from near the middle to the cuneate entire base, and coarsely serrate above,

Fig. 363

when they unfold dark green on the upper surface, pale on the lower surface, and villose with short white hairs on both sides of the midrib and veins, nearly fully grown when the flowers open at the end of April, and at maturity coriaceous, lustrous, glabrous, $1\frac{1}{4}'$–$1\frac{1}{2}'$ long, and $\frac{1}{2}'$–$1'$ wide, with a stout yellow midrib and few slender prominent primary veins; petioles

villose early in the season, becoming glabrous, usually about $\frac{1}{2}'$ in length; leaves at the end of vigorous shoots usually elliptic, acute, coarsely serrate, frequently 3′ long and $1\frac{1}{2}'$ wide, with stouter and more broadly winged petioles. **Flowers** $\frac{3}{4}'$–1′ in diameter, on slender pedicels, in broad many-flowered glabrous corymbs; calyx-tube broadly obconic, glabrous, the lobes elongated, linear-lanceolate, entire or occasionally slightly dentate; stamens 20; anthers large, bright rose color; styles two or three, surrounded at base by conspicuous tufts of white hairs. **Fruit** ripening late in October or in November, on slender pedicels about $\frac{1}{2}'$ long, in few-fruited drooping clusters, short-oblong, green tinged with dull red, $\frac{1}{3}'$ long, with only slightly enlarged erect and incurved calyx-lobes mostly deciduous before the fruit ripens; flesh thin, green, dry and hard; nutlets 2 or 3, with a high rounded ridge, $\frac{1}{4}'$ long.

A tree, 15°–20° high, with a trunk 8′–10′ in diameter, covered with dark scaly bark, small spreading branches forming a broad open irregular head, and nearly straight dull chestnut-brown branchlets gray-brown in their second year, and unarmed or sparingly armed with stout straight chestnut-brown spines $1\frac{1}{2}'$–$1\frac{3}{4}'$ long.

Distribution. Rich upland woods near Fulton, Hemstead County, southern Arkansas; Chopin, Natchitoches Parish, near Winn, Winnfield Parish, and Lake Charles, Calcasieu Parish, Louisiana; in the neighborhood of Marshall, Harris County, Texas.

12. Cratægus Cocksii Sarg.

Leaves oblong-obovate, acute or rounded at apex, gradually narrowed and cuneate at base, finely serrate above the middle with straight acuminate teeth, glabrous, dark green

Fig. 364

and lustrous above, dull and paler below, 1′–$1\frac{1}{4}'$ long, and $\frac{1}{4}'$–$\frac{1}{2}'$ wide, with a slender midrib and primary veins mostly within the parenchyma; petioles slender, about $\frac{1}{6}'$ in length, leaves at the end of vigorous shoots broad-obovate, rounded or abruptly short-pointed at apex, thicker, more coarsely serrate, often $1\frac{1}{2}'$ long and 1′ wide. **Flowers** $\frac{1}{2}'$–$\frac{3}{4}'$ in diameter, on slender pedicels, in compact few-flowered glabrous corymbs; calyx-tube broadly obconic, glabrous, the lobes oblong-ovate, gradually narrowed and acuminate, entire, sparingly villose on the inner surface; stamens 20, small, pale rose color; styles 2 or 3, surrounded at base by clusters of white hairs. **Fruit** ripening in October, on slender pedicels about $\frac{1}{3}'$ in length, in few-fruited clusters, short-oblong to slightly obovoid, crimson, lustrous, $\frac{1}{3}'$–$\frac{1}{2}'$ long, with spreading calyx-lobes mostly deciduous from the ripe fruit; nutlets 2 or 3, obovoid, acute at apex, rounded at base, prominently ridged on the back, $\frac{1}{3}'$ long.

A slender tree, 20°–25° high, with a tall trunk 4′–6′ in diameter, with dark red-brown bark covered with small closely appressed scales, smooth slender drooping branches forming a broad open head, and slender bright red-brown pendulous branchlets becoming gray in their second year, and armed with straight slender dark chestnut-brown lustrous spines $1\frac{1}{4}'$–$1\frac{3}{4}'$ in length.

Distribution. Low rich woods at the marble quarry near Winnfield, Winn Parish, Louisiana.

Distinct in the Crus-galli Group in its head of slender pendulous branches.

13. Cratægus arborea Beadl.

Leaves obovate to oblanceolate, narrowed, acute or rounded at apex, gradually narrowed and concave-cuneate at the long tapering entire base, and finely serrate above the middle with minute straight teeth, nearly fully grown when the flowers open the middle of April and then glabrous, and at maturity subcoriaceous, bright green and lustrous above, pale below, $1\frac{3}{4}'$–$2'$ long, and about $\frac{3}{4}'$ wide; turning in the autumn orange, yellow, and brown;

Fig. 365

petioles $\frac{1}{3}'$–$\frac{2}{3}'$ in length; leaves at the end of vigorous shoots coarsely serrate, occasionally slightly lobed, and often $3'$ long and $1\frac{1}{2}'$ wide. **Flowers** $\frac{1}{2}'$ in diameter, on slender pedicels, in broad many-flowered glabrous corymbs; calyx narrowly obconic, glabrous, the lobes slender, elongated, acuminate, slightly serrate; stamens 20; anthers pale yellow; styles usually 2. **Fruit** ripening in September and October, globose to subglobose, $\frac{1}{4}'$–$\frac{1}{3}'$ in diameter, red, the calyx enlarged, with elongated coarsely glandular-serrate reflexed lobes; nutlets usually 2, about $\frac{1}{4}'$ long.

A tree, sometimes 30° high, with a trunk $12'$–$18'$ in diameter, spreading or ascending branches forming a broad handsome head, and branchlets orange-green in their first season, becoming reddish in their first winter, and usually unarmed.

Distribution. In open woods usually in clay soil near Montgomery, Montgomery County, Alabama.

14. Cratægus uniqua Sarg.

Leaves oblong-obovate, acute or occasionally rounded at apex, gradually narrowed to the long cuneate base, and finely serrate above the middle with straight or incurved glandular teeth, more than half grown and sparingly villose on the upper side of the midrib when the flowers open the middle of April, and at maturity glabrous, dark green and lustrous above, paler below, $1'$–$1\frac{1}{2}'$ long, and $\frac{1}{2}'$–$\frac{3}{4}'$ wide, with a thin midrib, and slender primary veins mostly within the parenchyma; petioles slender, glabrous, $\frac{1}{3}'$–$\frac{1}{2}'$ in length; leaves at the end of vigorous shoots broad-obovate, rounded or acute at apex, coarsely serrate, $2'$–$2\frac{1}{2}'$ long, and $1'$–$1\frac{1}{4}'$ wide. **Flowers** $\frac{2}{5}'$–$\frac{1}{2}'$ in diameter, on slender pedicels, in mostly 5–8-flowered glabrous corymbs; calyx-tube narrowly obconic, the lobes short and broad, acuminate, entire or slightly dentate near the middle, sparingly villose on the inner surface; stamens 20; anthers small, nearly white; styles 2 or 3. **Fruit** on slender drooping pedicels, short-oblong, rounded at the ends, dull red, about $\frac{1}{2}'$ long and $\frac{1}{3}'$ thick; calyx prominent, with

reflexed closely appressed persistent lobes; flesh thin, dry and hard; nutlets 2 or 3, broad and rounded at base, narrowed at apex, about ¼′ long.

A tree, 18°–20° high, with a slender stem covered with close dark slightly ridged bark, small wide-spreading branches forming a flat-topped head, and slender slightly zigzag

Fig. 366

orange or red-brown branchlets unarmed, or armed with few or many straight or slightly curved dark chestnut-brown shining spines ½′–1′ in length.

Distribution. Woods in low sandy soil; eastern Texas (near Marshall, Harrison County, and Livingston, Polk County), to southwestern Arkansas.

15. Cratægus Engelmannii Sarg.

Leaves oblong-obovate or rarely elliptic, rounded or often short-pointed and acute at apex, gradually narrowed or entire below, finely crenulate-serrate usually only above the middle

Fig. 367

and generally only at the apex, nearly fully grown and roughened on the upper surface by short rigid pale hairs when the flowers open about the middle of May, and at maturity

coriaceous, dark green, lustrous and scabrate above, pale below, and pilose on both surfaces of the slender midrib and obscure primary veins and veinlets, 1′–1½′ long, and ½′–1′ wide; petioles glandular, villose when they first appear, soon glabrous, usually about ¼′ in length. **Flowers** ¾′ in diameter, on slender pedicels, in broad loose 8–11-flowered villose corymbs; calyx-tube narrowly obconic, villose or nearly glabrous, the lobes narrow, acuminate, entire, glabrous on the outer surface, usually puberulous on the inner surface; stamens 10; anthers small, rose color; styles 2 or 3. **Fruit** ripening early in November, on slender pedicels, in drooping many-fruited glabrous clusters, globose or short-oblong, bright orange-red, with a yellow cheek, about ½′ in diameter; calyx prominent, with large spreading lobes usually deciduous before the fruit ripens; nutlets 2 or 3, thick, with a broad rounded ridge, ¼′ long.

A tree, 15°–20° high, with a trunk 5′–6′ in diameter, wide-spreading usually horizontal branches forming a low flat-topped or rounded head, and branchlets covered with long pale hairs when they first appear, soon glabrous and bright red-brown, becoming gray or gray tinged with red during their second year, and armed with numerous stout straight or slightly curved spines 1½′–2½′ long.

Distribution. Dry limestone slopes and ridges; common near Allenton and Pacific, St. Louis and Franklin counties, Missouri; near Eureka Springs, Carroll County, Arkansas, southern Illinois, western Kentucky and Hot Spring and Van Buren Counties, Arkansas.

16. Cratægus montivaga Sarg.

Leaves obovate to oval, rhombic or suborbicular, rounded, acute or acuminate or abruptly short-pointed at apex, concave-cuneate at base, and sharply coarsely serrate usually

Fig. 368

to below the middle with straight acuminate glandular teeth, covered above with short white hairs and glabrous below when they unfold, and at maturity dark green, lustrous and scabrate above, pale yellow-green below, 1′–1¼′ long, and ¾′–1′ wide, with a slender midrib and prominent primary veins; petioles slender, villose early in the season, becoming glabrous, about ¼′ in length. **Flowers** opening late in April, about ½′ in diameter, on villose pedicels ¼′–½′ long, in compact mostly 7–10-flowered villose corymbs, their bracts and bractlets linear-obovate, conspicuously glandular-serrate; calyx-tube broadly obconic, glabrous or with occasional hairs near the base, the lobes gradually narrowed from a wide base, glandular-serrate, sometimes laciniate near the acuminate apex, glabrous on the outer surface, villose on the inner surface; stamens 10–15, usually 10; anthers pink; styles 2 or 3. **Fruit** ripening late in September or in October, on erect nearly glabrous or villose pedicels, short-oblong to ellipsoid, orange-red, about ½′ long; the calyx enlarged and conspicuous; flesh thin, yellow-green; nutlets 2 or 3, rounded at apex, with a low broad rounded ridge, about ¼′ long.

A bushy tree, rarely more than 12°–15° high, with a short trunk 10′–12′ in diameter, erect

and spreading branches, and slender nearly straight branchlets orange-brown and covered with long scattered pale hairs when they first appear, dull red-brown and glabrous at the end of their first season, becoming gray the following year. Bark of the branches smooth and dark brown, becoming slightly scaly on the trunk.

Distribution. Rocky banks of streams; western Texas (Comal, Kendall, Bandera, Edwards, Brown and Calhoun Counties, and on the Davis Mountains, Jeff Davis County); common on the banks of the Guadalupe and other streams on the Edwards Plateau.

Interesting as the extreme southwestern representative of the Crus-galli Group, and its only species in western Texas.

17. Cratægus denaria Beadl.

Leaves oval, oblong-obovate or elliptic, acute or acuminate at apex, gradually narrowed from near the middle and cuneate and entire below, and coarsely often doubly serrate above

Fig. 369

with straight teeth, when they unfold tinged with red and slightly pilose above and glabrous below, nearly fully grown when the flowers open toward the end of May, and at maturity firm to subcoriaceous, bright green and lustrous on the upper surface, pale on the lower surface, $2\frac{1}{2}'$–$3'$ long, and $\frac{3}{4}'$–$1\frac{1}{4}'$ wide, with a slender midrib and few remote thin primary veins; turning in the autumn orange, yellow, or brown; petioles stout, conspicuously glandular, and about $\frac{1}{4}'$ in length; leaves at the end of vigorous shoots broadly oval to ovate or obovate, occasionally incisely lobed, $2\frac{1}{2}'$–$3'$ long, and $1\frac{1}{2}'$–$2'$ wide. **Flowers** $\frac{1}{2}'$–$\frac{2}{3}'$ in diameter, on long slender pedicels, in broad lax many-flowered sparingly villose corymbs; calyx narrowly obconic, glabrous, the lobes slender, elongated, acuminate and glandular at apex, mostly entire or slightly serrate below; stamens usually 10; styles 3–5. **Fruit** on long slender pedicels, in drooping few-fruited clusters, globose to subglobose, $\frac{1}{4}'$–$\frac{5}{16}'$ in diameter, orange-red, the calyx somewhat enlarged, with spreading or closely appressed lobes; nutlets 3–5, slightly ridged on the back, about $\frac{3}{16}'$ long.

A tree, 18°–20° high, with a trunk sometimes 8′ in diameter, spreading branches, and branchlets sparingly villose with long matted white hairs when they first appear, soon glabrous, and unarmed or armed with occasional straight slender spines about $1\frac{1}{2}'$ long.

Distribution. Banks of streams, eastern Mississippi; common in the neighborhood of Columbus, Lowndes County.

18. Cratægus signata Beadl.

Leaves obovate to elliptic, rounded and often short-pointed or acute at apex, gradually narrowed from near the middle and cuneate at the entire base, and sharply glandular-

serrate usually only above the middle, about half grown when the flowers open early in April, and then gray-green and coated above and on the lower side of the midrib and principal veins with short pale hairs, and at maturity thin and firm in texture, dark green, lustrous and slightly pilose above, paler and pubescent below on the slender midrib and 2–5 pairs of primary veins, $1\frac{1}{2}'$–$2'$ long, and $\frac{3}{4}'$–$1'$ wide; petioles slender, grooved above, glandular, usually about $\frac{1}{3}'$ in length; leaves at the end of vigorous shoots often broad-ovate to elliptic, coarsely dentate or sometimes incisely lobed, frequently $2\frac{1}{2}'$ long and $2'$ wide. **Flowers** about $\frac{3}{4}'$ in diameter, on slender pedicels, in few-flowered compact hairy corymbs; calyx-tube narrowly obconic, villose with long matted hairs, the lobes narrow, acute, entire or irregularly glandular-serrate, usually glabrous on the outer surface, villose on the inner surface; stamens 10; styles 3–5, surrounded at base by a few pale hairs. **Fruit** ripening and falling toward the end of October, in few-fruited drooping slightly villose

Fig. 370

clusters, short-oblong, rounded at the ends, dark red, more or less pruinose, marked by numerous pale dots, and about $\frac{1}{2}'$ long; calyx enlarged, with elongated closely appressed lobes usually persistent on the ripe fruit; flesh thin and yellow; nutlets 3–5, prominently ridged and grooved on the back, about $\frac{1}{4}'$ long.

A tree, usually 15°–18° high, with a tall trunk $4'$–$5'$ in diameter, covered with ashy gray bark, often nearly black near the base of old stems, and separating freely into thin plate-like scales, numerous ascending or spreading branches forming a round-topped or oval compact head, and stout chestnut-brown branchlets armed with stout, nearly straight bright chestnut-brown spines $1'$–$2'$ long.

Distribution. Open glades and dry copses of the Pine-covered coast-plain of southern Alabama.

19. Cratægus edita Sarg.

Leaves oblong-obovate or rarely elliptic, acute at the gradually narrowed apex, gradually narrowed from near the middle to the cuneate entire base, and coarsely and often doubly serrate above, when the flowers open from the 15th to the 20th of April lustrous and scabrate on the upper surface with short rigid pale hairs and puberulous on the lower surface, and at maturity coriaceous, dark green, lustrous, and slightly roughened above, pale yellow-green and scabrate below, $1\frac{1}{2}'$–$2'$ long, and $\frac{1}{2}'$–$1'$ wide; petioles stout, villose, becoming pubescent or puberulous, $\frac{1}{3}'$–$\frac{1}{2}'$ in length; leaves at the end of vigorous shoots often slightly divided into lateral lobes, more coarsely serrate and sometimes $3'$ long, and $1\frac{1}{2}'$ wide, with stout broadly winged petioles. **Flowers** $\frac{1}{2}'$–$\frac{3}{4}'$ in diameter, on slender villose

pedicels, in villose few-flowered narrow corymbs; calyx-tube narrowly obconic, glabrous or slightly hairy toward the base, the lobes linear-lanceolate, usually entire or obscurely glandular-serrate, glabrous on the outer surface and puberulous on the inner surface; stamens 20; anthers small, rose color; styles 2 or 3. **Fruit** ripening early in October or in November, on stout glabrous or slightly villose pedicels usually about $\frac{1}{2}'$ long, in drooping few-fruited clusters, short-oblong, rounded at the ends, slightly pruinose, dull green tinged

Fig. 371

with red, $\frac{1}{4}'$–$\frac{1}{3}'$ long, with a prominent calyx-tube and elongated spreading lobes puberulous on the inner surface and often deciduous before the ripening of the fruit; flesh very thin, green, dry and hard; nutlets 2 or 3, with a broad low rounded ridge, $\frac{1}{4}'$ long.

A tree, in low moist ground sometimes 40° high, with a trunk 1° in diameter, free of branches for 18°–20°, stout horizontal branches forming a broad round symmetrical head, and nearly straight branchlets villose when they first appear, soon glabrous, light chestnut-brown becoming dark gray-brown in their second or third year, and armed with stout or slender straight chestnut-brown spines 1′–2′ long; or on the dry soil of low hills much smaller and generally 20°–25° high.

Distribution. Low wet woods on the borders of streams, and on dry hills in forests of Oak and Pine; near Marshall, Harris County, Texas; Natchitoches, Natchitoches Parish, and to the neighborhood of Shreveport, Louisiana.

20. Cratægus tersa Beadl.

Leaves oblong to obovate, rounded and obtuse at apex, gradually narrowed to the concave-cuneate entire base, and coarsely serrate above with acute or rounded teeth, when they unfold tinged with red, sparingly villose above and tomentulose below, nearly fully grown when the flowers open the middle of April, and at maturity coriaceous, dark green, lustrous, and glabrous or scabrate above, pale and pubescent below, $1\frac{1}{2}'$–$2'$ long, and $1'$–$1\frac{1}{4}'$ wide, with a slender midrib and thin primary veins; turning in the autumn yellow, orange, and brown; petioles stout, at first hoary-tomentose, glabrous at maturity, about $\frac{1}{2}'$ in length; leaves on the end of vigorous shoots, broad-obovate, short-pointed at the rounded apex, often $2'$ long and $1\frac{1}{2}'$ wide, with a prominent midrib and primary veins. **Flowers** $\frac{5}{8}'$–$\frac{3}{4}'$ in diameter, on short stout hairy pedicels, in usually 8–10-flowered very compact corymbs densely clothed with long matted pale hairs; calyx-tube narrowly obconic, villose, the lobes acuminate, glandular-serrate, villose on the outer and slightly pilose on the inner surface; stamens 18–20; anthers pale rose color, styles usually 2 or 3. **Fruit** ripening in October, on stout glabrous stems, in compact drooping few-fruited clusters, globose to subglobose or short-oblong, about $\frac{3}{8}'$ long, dark red; calyx prom-

inent, with enlarged erect or spreading glandular-serrate lobes; flesh thin, yellow, dry and mealy; nutlets 2 or 3, mostly obtuse and rounded at the ends, about $\frac{1}{4}'$ long.

Fig. 372

A tree, sometimes 18°–20° high, with a trunk 6′–8′ in diameter, spreading branches forming a broad flat-topped head, and stout chestnut-brown branchlets at first pilose, becoming glabrous before autumn, and usually unarmed.

Distribution. Low woods west of Opelousas, St. Landry Parish, Louisiana.

21. Cratægus berberifolia T. & G.

Leaves oblong-obovate to elliptic, rounded or gradually narrowed at apex, narrowed from above the middle to the cuneate entire base, and serrate above with straight or incurved teeth, nearly fully grown when the flowers open at the end of March or early in April and then roughened above by short rigid white hairs, and whitish and pubescent below,

Fig. 373

and at maturity subcoriaceous, dark green, lustrous and nearly glabrous on the upper surface, pale and pubescent on the lower surface especially on the thin midrib and slender primary veins, $1\frac{1}{2}'$–$2'$ long, and $\frac{3}{4}'$–$1'$ wide; petioles comparatively slender, at first densely villose, be-

coming glabrous, usually about $\frac{1}{2}'$ in length. **Flowers** $\frac{2}{3}$–$\frac{1}{2}'$ in diameter, on slender villose pedicels, in compact mostly 4–5-flowered villose corymbs; calyx-tube narrowly obconic, thickly coated with long matted pale hairs, the lobes slender, acuminate, sparingly villose or nearly glabrous on the outer surface, villose on the inner surface, entire or slightly serrate; stamens 20; anthers yellow; styles 2 or 3, surrounded at base by a narrow ring of pale hairs. **Fruit** ripening early in October, on slender pedicels, in few-fruited drooping puberulous clusters, subglobose, orange with a red cheek, about $\frac{1}{2}'$ in diameter; calyx-tube slightly enlarged, with spreading or incurved lobes; flesh thin and yellow; nutlets 2 or 3, slightly ridged on the back, about $\frac{1}{4}'$ long.

A tree, 20°–25° high, with a tall trunk 8′–10′ in diameter, covered with dark gray scaly bark, stout branches spreading into a broad flat-topped head, and slender branchlets covered at first with matted white hairs, becoming glabrous and light orange-brown at the end of their first season, and pale gray-brown the following year, and unarmed or armed with occasional slender nearly straight red-brown spines $1'$–$1\frac{1}{2}'$ long.

Distribution. Borders of prairies and low moist soil a few miles west of Opelousas, St. Landry Parish, Louisiana.

22. Cratægus edura Beadl.

Leaves oblong-obovate, rounded and obtuse or occasionally acute at apex, gradually narrowed from above the middle to the cuneate base, and serrate only at the apex, nearly fully grown when the flowers open early in April and then thin, dark green and puberulous

Fig. 374

above especially on the midrib, very pale and villose below, and at maturity thick and coriaceous, $1\frac{1}{4}'$–$1\frac{1}{2}'$ long, and $1\frac{1}{2}'$–$1\frac{3}{4}'$ wide, with a slender midrib, and primary veins within the parenchyma; turning in the autumn orange, yellow, or brown; petioles slender, light yellow, pilose, $\frac{1}{8}'$–$\frac{1}{4}'$ in length. **Flowers** $\frac{3}{8}'$–$\frac{1}{2}'$ in diameter, on short sparingly villose pedicels, in compact hairy 5–12-flowered corymbs; calyx narrowly obconic, glabrous or with a few hairs at the base, the lobes narrow, acuminate, glabrous; stamens 16–20; anthers pale yellow or nearly white; styles 2 or 3. **Fruit** ripening and falling in September, in few-fruited drooping clusters, subglobose, orange or yellow with a red cheek, about $\frac{5}{16}'$ in diameter; calyx-lobes little enlarged, closely appressed, often deciduous; nutlets 2 or 3, rather obscurely ridged on the back, about $\frac{1}{4}'$ long.

A tree, 20°–25° high, with a trunk 6′–8′ in diameter, branches spreading out into a broad flat-topped head, and branchlets pilose when they first appear, soon glabrous, becoming reddish brown, unarmed or armed with chestnut-brown or gray spines $1\frac{1}{2}'$–$2'$ long.

Distribution. Low woods near Opelousas, St. Landry Parish, Louisiana.

23. Cratægus crocina Beadl.

Leaves oblong-obovate, rounded or acute at apex, gradually narrowed and cuneate at the slender entire base, and sharply serrate above the middle with straight or incurved glandular teeth, when they unfold more or less pubescent, and at maturity subcoriaceous, dark green, lustrous and glabrous or glabrate above, pale and covered below with short matted pale hairs most abundant on the thin midrib and obscure primary veins, $1\frac{1}{4}'$–$2'$

Fig. 375

long, and $\frac{1}{2}'$–$1'$ wide; turning in the autumn orange, yellow, or brown; petioles slender, puberulous, about $\frac{1}{4}'$ in length; leaves at the end of vigorous shoots elliptic to oblong-obovate, acuminate more coarsely serrate, often $2\frac{1}{2}'$ long and $\frac{5}{8}'$ wide. **Flowers** opening at the end of April when the leaves are fully grown, $\frac{1}{2}'$–$\frac{5}{8}'$ in diameter, on short villose pedicels, in compact few-flowered villose corymbs; calyx narrowly obconic, coated with matted white hairs, the lobes narrow, acute, entire or sparingly serrate, glabrous on the outer surface, slightly villose on the inner surface toward the apex; stamens 20; anthers yellow; styles usually 2 or 3. **Fruit** ripening in October, ellipsoidal or short-oblong, nearly $\frac{1}{2}'$ long, yellow, the calyx prominent, with elongated mostly recurved lobes; nutlets usually 2, narrowed and acute at the ends, ridged on the back, about $\frac{1}{4}'$ long.

A tree, 18°–20° high, with a short trunk 4′–6′ in diameter, spreading branches forming a wide flat-topped head, and slender mostly unarmed branchlets covered at first with matted pale hairs, and dark orange-brown and puberulous in their first winter.

Distribution. Low woods near Opelousas, St. Landry Parish, Louisiana.

24. Cratægus fera Beadl.

Leaves oblong-obovate, rounded or rarely acute at apex, gradually narrowed and concave-cuneate at the slender entire base, and sharply serrate above the middle with straight or incurved teeth, fully grown when the flowers open the middle of April and then thin, covered above by short white hairs, and slightly villose along the midrib and veins below, and at maturity coriaceous, dark green, scabrate and lustrous on the upper surface, pale and puberulous on the lower surface on the slender midrib and obscure primary veins, $2\frac{1}{2}'$–$3'$ long, and about $\frac{3}{4}'$ wide; turning in the autumn orange, yellow, or brown; petioles slender, pubescent early in the season, becoming puberulous, $\frac{3}{8}'$–$\frac{5}{8}'$ in length; leaves at the end of vigorous shoots oblong-obovate, rounded or acute and often short-pointed at apex, coarsely serrate, often $2\frac{1}{2}'$ long, and $1\frac{1}{4}'$ wide. **Flowers:** $\frac{1}{2}'$ in diameter, on long slender villose pedicels, in broad lax compound many-flowered corymbs covered more or less thickly with white hairs; calyx-tube narrowly obconic, slightly hairy near the base, gla-

brous above, the lobes narrow, acuminate, entire or sparingly glandular-dentate, glabrous on the outer surface and puberulous on the inner surface; stamens 16–20; anthers light yellow; styles usually 2 or 3. **Fruit** ripening in September and October, on long slender pedicels, in few-fruited drooping clusters, globose or subglobose, bright red or scarlet, $\frac{3}{8}'$ in diameter; flesh thin and mealy; calyx enlarged, with spreading or erect persistent lobes; nutlets 2 or 3, with a high narrow ridge, $\frac{1}{4}'$–$\frac{5}{16}'$ long.

Fig. 376

A tree, sometimes 20° high, with a trunk 8′–9′ in diameter, spreading branches forming a broad flat-topped head, and slender nearly straight branchlets, villose at first, becoming glabrous, pale reddish brown, ultimately ashy gray, and sometimes armed with slender straight spines 1′–$1\frac{1}{4}'$ long.

Distribution. Low open Oak and Hickory woods near Opelousas, St. Landry Parish, and Natchitoches, Natchitoches Parish, Louisiana.

25. Cratægus Mohrii Beadl.

Leaves obovate or rhombic, acute or acuminate, gradually narrowed and cuneate at the entire base, and coarsely, occasionally doubly serrate above with straight or incurved teeth,

Fig. 377

when they unfold glabrous and slightly villose along the midrib and the lower side of the principal veins, nearly fully grown when the flowers open early in May, and at maturity thin and firm or subcoriaceous, dark green and very lustrous above, pale below, 1′–1½′ long, and ⅔′–1′ wide, usually with 4 pairs of thin primary veins, a stout midrib sometimes puberulous on the under side and bright red in the autumn; petioles frequently red at maturity, ⅓′–½′ in length; leaves at the end of vigorous shoots sometimes 3′ long and 2′ wide, mostly broad-elliptic, acute or acuminate, coarsely doubly serrate, and frequently divided toward the apex into short broad acute lobes; petioles, strait, glandular; petioles broadly winged, and occasionally glandular with minute dark glands. **Flowers** cup-shaped, about ¾′ in diameter, on slender elongated pedicels, in loose thin-branched many-flowered glabrous or villose corymbs; calyx-tube narrowly obconic, glabrous or occasionally pilose toward the base, the lobes linear-lanceolate, entire or finely glandular-serrate; stamens 20; anthers small, light yellow; styles 3–5, surrounded at base by a narrow ring of pale hairs. **Fruit** ripening about the middle of October, gracefully drooping on elongated thin bright red pedicels, in many-fruited clusters, subglobose to short-oblong, somewhat flattened at apex, full and rounded at base, bright orange-red, about ⅓′ in diameter; calyx prominent, with a short tube and usually erect lobes often deciduous before the fruit ripens; nutlets usually 3, about ¼′ long.

A tree, from 20°–30° high, with a tall straight trunk 6′–8′ in diameter, covered with thin ashy gray or light red-brown bark, sometimes armed with long slender or branched spines, spreading slightly pendulous branches forming a rather open broad symmetrical head, and branchlets furnished with thin nearly straight bright chestnut-brown shining spines 1′–1½′ long.

Distribution. Western Georgia to central Alabama and eastern Mississippi, and northward to middle Tennessee; abundant and of its largest size in the low flat woods near Birmingham, Jefferson County, Alabama, ascending into the poorer and drier soils of the neighboring hillsides and low mountain slopes.

II. PUNCTATÆ.

CONSPECTUS OF THE ARBORESCENT SPECIES.

Fruit usually short-oblong.

Anthers rose color or yellow; stamens 20; leaves obovate, often acutely lobed above the middle, their veins deeply impressed; fruit on stout pedicels, short-oblong to subglobose, flattened at the ends, dull red or bright yellow, marked by large pale dots. 26. **C. punctata** (A).

Anthers rose color; stamens 10–20; leaves oblong-obovate or oval, their veins not deeply impressed, fruit on long slender pedicels, short-oblong to obovoid, rounded at the ends, dull brick-red, marked by large pale dots. 27. **C. pausiaca** (A).

Fruit usually globose or subglobose.

Stamens 20.

Anthers pale yellow.

Corymbs villose.

Leaves obovate to oval or rarely rhombic, acute; fruit globose, or sometimes broader than high, dull red, marked by small pale dots. 28. **C. collina** (A, C).

Leaves obovate, oval, or ovate, acute or acuminate, incisely lobed; fruit globose, dull red. 29. **C. amnicola** (C).

Corymbs glabrous; leaves broadly oval to ovate, rounded or acute at apex, occasionally rounded at base, subcoriaceous; fruit subglobose to short-oblong, dull orange-red, marked by large pale dots. 30. **C. fastosa** (C).

Anthers rose color.

Leaves scabrate on the upper surface.

Leaves ovate, oval or rarely obovate, acuminate; flowers in compact usually 6–8-flowered corymbs. 31. **C. sylvestris** (A).

Leaves obovate to rhombic, acute or rarely rounded at apex; flowers in wide usually 9–12-flowered corymbs. **32. C. verruculosa.**

Leaves glabrous on the upper surface.

Corymbs slightly villose.

Leaves obovate to rhombic, acute or rounded at apex; fruit globose, dark dull red. **33. C. sordida** (C).

Leaves oval to obovate, acute or acuminate at apex; fruit often rather longer than broad, bright canary-yellow. **34. C. brazoria** (C).

Corymbs densely villose; leaves obovate, acute, acuminate or rounded at apex; fruit subglobose, dark dull red. **35. C. dallasiana** (C).

Stamens 10.

Anthers pale yellow; leaves obovate, acute or acuminate or rounded and short-pointed at apex; fruit subglobose, pubescent at the ends, dull orange-red. **36. C. Lettermanii** (A).

Anthers rose color; leaves oblong-obovate, acute or rounded at apex; fruit globose, bright scarlet, slightly pruinose. **37. C. pratensis** (A).

26. Cratægus punctata Jacq.

Leaves obovate, pointed or rounded at apex, gradually narrowed to the cuneate entire base, sharply and often doubly serrate above the middle with minute teeth, and sometimes more or less incisely lobed, thickly covered below with pale hairs and pilose above when

Fig. 378

they unfold, about half grown when the flowers open from the middle of May until early in June and then pilose on the midrib and veins below and nearly glabrous above, and at maturity thick and firm, pale gray-green and glabrous on the upper surface, more or less villose on the lower surface, 2′–3′ long, and $\frac{3}{4}$′–1$\frac{1}{2}$′ wide, with a broad prominent midrib, and primary veins deeply impressed on the upper surface; turning bright orange or orange and scarlet in the autumn; petioles stout, at first villose or tomentose, becoming pubescent or glabrous, $\frac{1}{4}$′–$\frac{1}{2}$′ in length; leaves at the end of vigorous shoots usually incisely lobed, and often 3′–4′ long and 1$\frac{1}{2}$′–2′ wide. **Flowers** $\frac{1}{2}$′–$\frac{3}{4}$′ in diameter, on slender villose pedicels, in tomentose or villose many-flowered compact corymbs; calyx-tube narrowly obconic, villose or tomentose, the lobes narrow, acute, nearly entire or minutely glandular-serrate, villose on the inner surface; stamens 20; anthers rose color or yellow; styles 5, surrounded at base by conspicuous tufts of white hairs. **Fruit** ripening and falling in October, on elongated nearly glabrous pedicels, in drooping clusters, short-oblong to subglobose, truncate at the ends dull red or bright yellow (var. *aurea* Ait.) and usually agreeing with the anthers in color, marked by numerous small white dots, $\frac{1}{2}$′–1′ long; nutlets 5, about $\frac{1}{4}$′ long.

A tree, 20°–30° high, with a trunk occasionally a foot in diameter, stout branches spreading nearly at right angles and forming a round or flat-topped head, or sometimes ascending and forming a narrow open irregular head, and branchlets coated at first with pale deciduous pubescence, becoming light orange-brown or ashy gray, and armed with slender straight light orange-brown or gray spines 2′–3′ long.

Distribution. Common and generally distributed; rich hillsides; valley of the Chateaugay River, Quebec, to the valley of the Detroit River, Ontario, southward through western New England to Delaware, and along the Appalachian Mountains to northern Georgia, ascending in North Carolina and Tennessee to altitudes of nearly 6000°, and westward through New York, Ohio and Indiana to southern Michigan, Indiana, Illinois, southern Wisconsin, southeastern Minnesota, and in central Iowa. A form (var. *canescens* Britt.), densely hoary-tomentose on the under surface of the leaves, and on the petioles and corymbs, occurs in Bucks County, Pennsylvania, and near Albany, Albany County, New York; and a form (var. *microphylla* Sarg.) with smaller leaves and compact few-flowered corymbs has been found at Linesville, Crawford County, Pennsylvania.

27. Cratægus pausiaca Ashe.

Leaves oblong-obovate to oval, rounded or acute at apex, gradually narrowed from near the middle to the concave-cuneate entire base, and finely doubly serrate above with straight glandular teeth, more than half grown when the flowers open from the 20th to the end of

Fig. 379

May and then membranaceous, dark yellow-green, and slightly villose above and along the under side of the midrib and veins, and at maturity glabrous, dark yellow-green above, paler below, 2′–2½′ long, and 1¼′–1½′ wide, with a slender yellow midrib, and 5 or 6 pairs of primary veins extending very obliquely to the end of the leaf; petioles slender, wing-margined above the middle, villose only early in the season, ⅝′–1′ in length; leaves at the end of vigorous shoots elliptic to rhombic, long-pointed, slightly or deeply divided into broad lateral lobes, coarsely serrate, often 3½′–4′ long and 2′–2½′ wide. **Flowers** ½′ in diameter, on long slender hairy pedicels, in broad many-flowered thin-branched villose corymbs; calyx-tube narrowly obconic, villose below with closely appressed white hairs, glabrous above, the lobes abruptly narrowed from the base, slender, acuminate, tipped with minute dark glands, entire or occasionally obscurely toothed above the middle, glabrous on the outer surface, villose on the inner surface; stamens 10–15, rarely 20; anthers dark rose color; styles 2 or 3, surrounded at base by a broad ring of pale tomentum. **Fruit** ripening about the middle of October, on elongated slender slightly hairy pedicels, in drooping many-fruited clusters, short-oblong to obovoid, broad and rounded at the ends, dull brick-

red, marked by large pale dots, $\frac{5}{16}'$–$\frac{9}{16}'$ long, and about $\frac{3}{8}'$ thick; calyx small, with spreading appressed lobes mostly deciduous from the ripe fruit; flesh thin, hard, slightly juicy, green or greenish yellow; nutlets 3 or 4, thin, acute or obtuse at the ends, ridged on the back with a high broad deeply grooved ridge, about $\frac{1}{4}''$ long.

A tree, 20°–25° high, with a tall straight trunk often a foot in diameter, covered with dark brown scaly bark, stout wide-spreading branches forming a broad symmetrical round or flat-topped head, slender straight branchlets light orange-green and sparingly villose at first, becoming light orange-brown during their first season, light or dark gray-brown the following year, and armed with numerous stout slender straight orange-brown shining spines $1\frac{1}{2}'$–$2'$ in length, long persistent on the branches and trunk, finally ashy gray, and becoming sometimes a foot long, with long slender lateral spines.

Distribution. Dry limestone hills and low moist bottom-lands, Bucks, Berks and Delaware counties, eastern Pennsylvania; at Chapin, Ontario County, New York.

28. Cratægus collina Chapm.

Leaves obovate to oval or occasionally to rhombic, acute, gradually narrowed or broadly cuneate at the entire base, and irregularly and often doubly serrate above with glandular incurved or straight teeth, when they unfold bright red and covered with soft pale hairs

Fig. 380

most abundant on the under side of the midrib and principal veins, less than one third grown when the flowers open at the end of April, and at maturity subcoriaceous, yellow-green on the upper surface, paler on the lower surface, glabrous with the exception of a few hairs on the under side of the stout yellow midrib and 4 or 5 pairs of slender primary veins, $1\frac{1}{2}'$–$2'$ in length, and $1'$–$1\frac{1}{4}'$ wide; petioles slender, villose, soon glabrous, more or less winged toward the apex, $\frac{1}{4}'$–$\frac{1}{2}$ long; leaves at the end of vigorous shoots frequently divided into short broad acute lateral lobes, more coarsely dentate and often 3′ long and $2\frac{1}{2}'$ wide, with a stout broadly winged petiole generally light red like the lower side of the base of the midrib. **Flowers** $\frac{3}{4}'$ in diameter, on long stout pedicels, in broad many-flowered villose corymbs; calyx-tube broadly obconic, villose particularly toward the base, the lobes gradually narrowed from a broad base, acuminate, usually glabrous on the outer surface, villose on the inner surface, finely glandular-serrate with dark glands, bright red toward the apex; stamens usually 20; anthers large, pale yellow; styles 5. **Fruit** ripening in September, on stout elongated pedicels, in few-fruited erect or drooping puberulous clusters, subglobose but sometimes rather broader than long, dull red, marked by small pale dots, $\frac{1}{3}'$–$\frac{1}{2}'$ in diameter; calyx enlarged, the lobes closely appressed, glandular-serrate, mostly persistent;

flesh yellow; nutlets 5, broad and rounded at the ends, ridged and often grooved on the back, about $\frac{1}{4}'$ long.

A tree, usually 15°–20° but occasionally 25° high, with a tall straight trunk often buttressed at base, frequently armed with numerous large much-branched spines sometimes 6′–8′ long, stout wide-spreading branches forming a handsome flat-topped symmetrical head, and branchlets tinged with red and villose with long matted silky white hairs when they first appear, soon puberulous, and dull reddish brown, becoming gray in their second year, and furnished with stout lustrous spines 2′–3′ long.

Distribution. Hillsides in rich soil in the foothill region of the southern Appalachian Mountains from southwestern Virginia to central Georgia and westward to northeastern Mississippi and middle Tennessee; in central Alabama; ascending to altitudes of 2500° above the sea.

29. Cratægus amnicola Beadl.

Leaves obovate, oval or ovate, acute or acuminate at apex, gradually narrowed and concave-cuneate at the entire base, coarsely sometimes doubly serrate above with straight or incurved glandular teeth, and incisely lobed above the middle with short acute or acu-

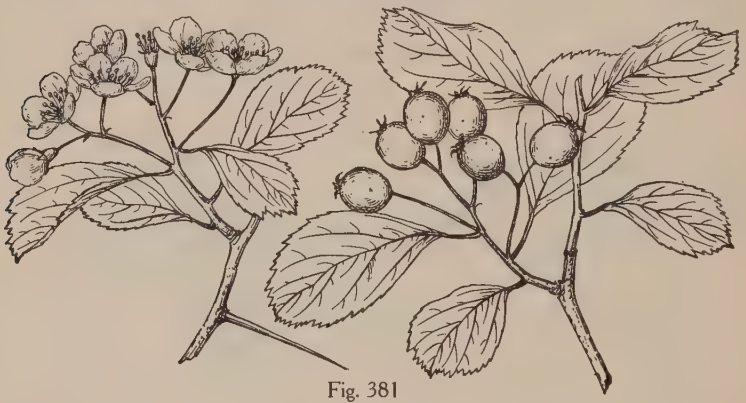

Fig. 381

minate lobes, deeply tinged with red and covered with short pale mostly caducous hairs when they unfold, about half grown and sparingly villose on the midrib and veins when the flowers open late in April or early in May, and at maturity subcoriaceous, bright green, glabrous, $1\frac{1}{4}'$–$1\frac{1}{2}'$ long, and 1′–$1\frac{1}{4}'$ wide; turning in the autumn yellow, orange, red, and brown; petioles slender, sparingly villose early in the season, becoming glabrous, sometimes slightly glandular, $\frac{1}{4}'$–$\frac{1}{3}'$ in length; leaves at the end of vigorous shoots sometimes 2′ long and $1\frac{1}{2}'$ wide. **Flowers** about $\frac{5}{8}'$ in diameter, on elongated slender slightly villose pedicels, in narrow many-flowered villose corymbs; calyx-tube narrowly obconic, glabrous or with a few scattered hairs at the base, the lobes narrow, acuminate, glandular-serrate, glabrous; stamens 20; anthers nearly white; styles 3–5. **Fruit** on slender elongated glabrous pedicels, in drooping few-fruited clusters, subglobose, dull red, about $\frac{1}{3}'$ in diameter; calyx enlarged, with elongated coarsely serrate reflexed conspicuous lobes; flesh yellow, thin, and firm; nutlets 3–5, rounded or slightly grooved on the back, nearly $\frac{1}{4}'$ long.

A tree, occasionally 25° high, with a trunk 8′–12′ in diameter, spreading or ascending branches forming a large wide head, and branchlets villose at first with long matted white hairs, soon glabrous, becoming orange-brown and ultimately ashy gray, and unarmed, or armed with stout spines $1\frac{1}{4}'$–2′ long.

Distribution. Low moist woods and the borders of streams, southeastern Tennessee, northwestern Georgia, and northeastern Alabama; common.

30. Cratægus fastosa Sarg.

Leaves broadly oval to ovate, rounded or acute at apex, concave-cuneate or rounded at the entire base, and coarsely doubly serrate above with straight glandular teeth, when they unfold covered above with long pale hairs and provided below with large tufts of snow-white tomentum in the axils of the primary veins, when the flowers open from the 20th to the 25th of April dark yellow-green and nearly glabrous on the upper surface and still tomentose in the axils of the veins below, and at maturity subcoriaceous, glabrous, yellow-green and lustrous above, pale yellow-green below, $1\frac{3}{4}'$–$2'$ long, and $1'$–$2'$ wide, with a prominent light yellow midrib deeply impressed on the upper side, and usually 3–5 pairs of primary veins; petioles slender, at first densely villose, becoming puberulous, $\frac{1}{2}'$–$\frac{3}{4}'$ in length; leaves at the end of vigorous shoots occasionally lobed with broad acute lobes. **Flowers** about $\frac{3}{4}'$ in diameter, on slender pedicels, in compact many-flowered glabrous corymbs, with large conspicuous oblong-obovate and acute to lanceolate coarsely glandular-serrate bracts and bractlets usually persistent until after the petals fall; calyx broadly obconic, the lobes abruptly narrowed at base, slender, acuminate, coarsely glandular-

Fig. 382

serrate, glabrous on the outer surface, villose on the inner surface; stamens 20; anthers pale yellow; styles 5, surrounded at base by a broad ring of pale tomentum. **Fruit** ripening from the middle to the end of October, on thin reddish pedicels, in few-fruited drooping clusters, subglobose to short-oblong, dull orange-red, marked by large pale dots, $\frac{3}{8}'$ in diameter; calyx enlarged, with spreading serrate lobes villose on the upper side, mostly deciduous from the ripe fruit; flesh thin, yellow-green; nutlets 3–5, thin, narrowed at the ends, obscurely ridged on the back with a broad low often grooved ridge, about $\frac{5}{16}'$ long.

A tree, 18°–20° high, with a short trunk 8′–12′ in diameter, covered with dark brown or nearly black scaly bark, small ascending branches forming an irregular open head, and slender nearly straight branchlets, dark orange-green tinged with red when they first appear, becoming before autumn bright reddish brown and very lustrous, and dull reddish brown the following year, and armed with numerous stout nearly straight bright chestnut-brown shining spines $1\frac{1}{2}'$–$2'$ long.

Distribution. Low woods near Fulton, Hempstead County, Arkansas; not common.

31. Cratægus silvestris Sarg.

Leaves ovate, oval or rarely obovate, acuminate, concave-cuneate or rounded at the entire base, sharply doubly serrate above with straight glandular teeth, and slightly divided above the middle into 3 or 4 pairs of small acuminate lobes, nearly fully grown when the flowers open at the end of May and then roughened above by short white hairs, and villose

below on the slender midrib and veins, and at maturity subcoriaceous, dark yellow-green lustrous and scabrate on the upper surface, paler and still villose on the lower surface, $2\frac{1}{4}'$–$2\frac{1}{2}'$ long, and $1\frac{3}{4}'$–$2'$ wide; petioles stout, slightly hairy on the upper side, occasionally glandular, and $\frac{3}{5}'$–$\frac{4}{5}'$ in length. **Flowers** $\frac{3}{5}'$ in diameter, on slender villose pedicels, in compact villose usually 6–8-flowered corymbs; calyx-tube narrowly obconic, glabrous, the lobes slender, acuminate, coarsely glandular-serrate, slightly villose on the inner surface; stamens 20; anthers pink; styles usually 3. **Fruit** ripening at the end of September, on slender reddish slightly hairy pedicels, in few-fruited erect or spreading clusters, subglobose to short-oblong, truncate at base, rounded at apex, dull orange-red, about $\frac{1}{2}'$ in diameter;

Fig. 383

calyx prominent with a broad deep cavity, and spreading coarsely serrate persistent lobes villose on the upper surface; flesh thick, dry and mealy; nutlets 3, gradually narrowed and rounded at the ends, ridged on the back with a high deeply grooved ridge, about $\frac{1}{3}'$ long and $\frac{1}{6}'$–$\frac{1}{5}'$ wide.

A tree, 30°–35° high, with a tall trunk often 1° in diameter, large ascending and spreading branches forming an open head, and stout nearly straight glabrous branchlets, light orange-green and marked by small pale lenticels when they first appear, becoming light chestnut-brown and lustrous in their first season, and dull red-brown the following year, and armed with slender straight or slightly curved dark chestnut-brown lustrous spines $1'$–$1\frac{1}{2}'$ long.

Distribution. Woods in low moist soil, near London, Ontario.

32. Cratægus verruculosa Sarg.

Leaves obovate to rhombic, acute or rarely rounded at apex, cuneate and entire at base, and sharply often doubly serrate above with straight or incurved glandular teeth, when they unfold dark red, covered above by short pale hairs and below by long matted white hairs most abundant on the midrib and veins, about half grown when the flowers open from the 1st to the 10th of May and then thin, dark yellow-green and scabrate on the upper surface, and paler and pubescent on the lower surface, and at maturity subcoriaceous, dark green, lustrous and nearly smooth above, pale and still pubescent below on the stout midrib and conspicuous primary veins extending very obliquely toward the end of the leaf, $1\frac{1}{2}'$–$2'$ long, and $1'$–$1\frac{1}{4}'$ wide; petioles stout, wing-margined at apex, at first villose, becoming pubescent or puberulous, $\frac{1}{4}'$–$\frac{1}{2}'$ in length; leaves at the end of vigorous shoots often broad-ovate to oval, sharply doubly serrate with straight teeth, sometimes slightly lobed above the middle with short acute lobes, and frequently $3'$ long and $2'$ wide. **Flowers** $\frac{3}{4}'$ in diameter, on long slender villose pedicels, in broad lax compound 6–12 usually 9-flowered villose corymbs; calyx-tube broadly obconic, thickly covered with matted pale hairs, the lobes gradually narrowed from a broad base, slender, acute, tinged with red at apex, spar-

ingly glandular-serrate, pubescent; stamens 20; anthers pale rose color; styles 3–5 surrounded at base by a broad ring of long pale hairs. **Fruit** ripening about the 1st of October, on stout pubescent pedicels, in drooping few-fruited clusters, subglobose, somewhat flattened and pubescent at the ends, dark red; calyx prominent, with more or less deciduous lobes; nutlets 3–5, narrowed and acute at the ends, rounded and very irregularly ridged and sometimes obscurely grooved on the back, about $\frac{1}{4}'$ long.

A tree, 20°–25° high, with a tall trunk 10′–12′ in diameter, thick spreading branches forming a broad compact round-topped symmetrical head, and stout nearly straight branchlets thickly covered with matted pale hairs when they first appear, becoming reddish

Fig. 384

or orange-brown, nearly glabrous and roughened by minute tubercles at the end of their first season, gray-brown the following year, and armed with numerous straight stout or slender dark chestnut-brown very lustrous spines $\frac{3}{4}'$–1′ long.

Distribution. Springfield, Greene County, Missouri, Hot Spring, Garland County, and Hempstead and Miller Counties, Arkansas; not rare.

33. Cratægus sordida Sarg.

Leaves rhombic, acute, or occasionally obovate and rarely rounded at apex, cuneate and entire below, serrate above with narrow straight or incurved glandular teeth, and occasionally irregularly divided above the middle into short acute lobes, about half grown when the flowers open the first week of May and then membranaceous, bright green, lustrous and glabrous with the exception of a few short caducous hairs on the upper surface, particularly on the midrib and principal veins, and at maturity subcoriaceous, dark green and lustrous above, paler below, generally about $1\frac{1}{2}'$ long and $1\frac{1}{4}'$ wide; petioles stout, slightly winged toward the apex, at first villose, soon glabrous, about $\frac{1}{2}'$ long, often bright red in the autumn; leaves at the end of vigorous shoots sometimes oblong or oval, coarsely dentate, usually divided above the middle into short acute lobes, 3′–4′ long, 2′–$2\frac{1}{2}'$ wide, and decurrent on the stout glandular petioles. **Flowers** 1′–$1\frac{1}{4}'$ in diameter, on slender pedicels, in few-flowered compact slightly villose corymbs; calyx-tube narrowly obconic, the lobes narrow, acuminate, villose on the inner surface; petals dull white; stamens 20; anthers small, rose color; styles 2 or 3, surrounded at base by a narrow ring of pale hairs. **Fruit** ripening and falling the middle of September, on short pedicels, in few-fruited drooping clusters, globose, $\frac{1}{3}'$–$\frac{1}{2}'$ in diameter, dark dull red; calyx prominent, with elongated coarsely serrate appressed or incurved lobes; flesh thin and yellow; nutlets 2 or 3, broad, rounded and ridged on the back with a low rounded ridge, $\frac{1}{4}'$ long.

A slender tree, 20°–25° high, with a tall trunk 5′–6′ in diameter, often armed with long-

branched spines, small ascending branches forming a narrow oval head, and slender nearly straight branchlets, dark orange-green and villose with long scattered pale hairs sometimes persistent until autumn, dull chestnut-brown in their second season, and dark

Fig. 385

gray-brown the following year, and furnished with numerous thin nearly straight bright chestnut-brown shining spines 1′–2½′ long, or often unarmed.

Distribution. Low woods and the gravelly banks of streams in Shannon, Carter, and Ripley Counties, southern Missouri.

34. Cratægus brazoria Sarg.

Leaves oval to obovate, acute or acuminate at apex, gradually narrowed, cuneate and entire at base, and coarsely and irregularly glandular-serrate above with straight spreading teeth, coated with hoary tomentum and often bright red when they unfold, nearly fully

Fig. 386

grown and covered with short soft pale hairs most abundant on the under side of the thin midrib and 3 or 4 pairs of primary veins when the flowers open from the middle to the end of March, and at maturity thin and firm in texture, glabrous, dark green and lustrous

above, paler below, 2′–2½′ long, and 1¼′–1½′ wide; petioles slender, early in the season tomentose, becoming glabrous or puberulous, ½′–¾′ in length; leaves at the end of vigorous shoots broad-ovate or oblong, rounded or broad-cuneate at base, coarsely dentate, 5′ long, and 2½′ wide. **Flowers** ¾′ in diameter, on long slender pedicels, in broad slightly villose 7 or 8-flowered corymbs; calyx-tube narrowly obconic, coated with long matted pale hairs, the lobes narrow, acuminate, obscurely glandular-serrate or nearly entire, villose on both surfaces; stamens 20; anthers small, dark red; styles 5, surrounded at base by a thin ring of hoary tomentum. **Fruit** ripening after the 1st of October, in spreading or drooping few-fruited clusters, subglobose and often rather longer than broad, bright canary-yellow, marked by occasional dark dots, ⅓′–½′ long; calyx prominent, the lobes usually deciduous before the fruit ripens; flesh thin, light yellow, rather dry but sweet and edible; nutlets 5, rounded and grooved on the back, ¼′ long.

A tree, 20°–25° high, with a tall straight trunk 8′–10′ in diameter, numerous ascending branches forming a handsome symmetrical round-topped head, and branchlets covered when they first appear with matted pale hairs, dull reddish brown and often puberulous in their second season, and reddish brown the following year, and unarmed or occasionally armed with long thin gray spines.

Distribution. Low rich woods near the banks of the Brazos River, Columbia and Brazoria, Brazoria County, Texas.

35. Cratægus dallasiana Sarg.

Leaves oblong, acute, acuminate or rounded at apex, gradually narrowed to the concave-cuneate entire base, coarsely doubly serrate above with straight glandular teeth, and usually slightly lobed above the middle, coated below with thick hoary tomentum and villose

Fig. 387

above as they unfold, nearly fully grown and villose or tomentose below when the flowers open early in April, and at maturity thin, dark yellow-green, glabrous and lustrous on the upper surface, pale and pubescent on the lower surface on the slender midrib and 3 or 4 pairs of thin arching veins, 1¾′–2½′ long, and 1¼′–1½′ wide; petioles slender, wing-margined toward the apex, hoary-tomentose early in the season, becoming glabrous, about ½′ in length. **Flowers** about ⅝′ in diameter, on long slender hairy pedicels, in many-flowered densely villose corymbs; calyx-tube narrowly obconic, densely coated with long matted pale hairs, the lobes slender, acuminate, tipped with a minute red gland, sparingly and irregularly glandular-serrate, villose; stamens 20; anthers light rose color; styles 5. **Fruit** ripening at midsummer, on stout erect slightly hairy pedicels, in few-fruited clusters, sub-

globose, dull dark red, $\frac{3}{8}'$–$\frac{1}{2}'$ in diameter; calyx prominent, with spreading lobes bright red on the upper side at the base; nutlets 5, acute at the narrow ends, thin, rounded and grooved with a broad shallow groove or irregularly ridged on the back, $\frac{1}{4}'$–$\frac{5}{16}'$ long.

A tree, 20°–25° high, with a tall trunk 4′–6′ in diameter, covered with pale bark, small erect branches forming an open irregular head, and slender somewhat zigzag branchlets thickly coated at first with hoary tomentum, reddish brown and lustrous before autumn, ultimately ashy gray, and armed with straight slender gray spines $1\frac{1}{4}'$–$1\frac{1}{2}'$ long.

Distribution. Forest-covered bottom-lands of the small tributaries of the Trinity River, Dallas County, Texas; not common.

36. Cratægus Lettermanii Sarg.

Leaves obovate, acute or acuminate or rounded and short-pointed at apex, gradually narrowed from near the middle and cuneate at the mostly entire base, coarsely often doubly serrate above with straight or incurved glandular teeth, and frequently slightly and

Fig. 388

irregularly divided above the middle into 3 or 4 pairs of short acute lobes, strongly plicate when they unfold and covered with a thick coat of pale tomentum, nearly half grown, roughened above by short pale hairs and pubescent below when the flowers open early in May, and at maturity thick, bright yellow-green and scabrate above, pale and pubescent below on the stout midrib and 4 or 5 pairs of primary veins, about 2′ long and $1\frac{1}{2}'$ wide; petioles stout, more or less winged above the middle, at first tomentose, becoming pubescent or nearly glabrous, usually about $\frac{3}{4}'$ in length; leaves at the end of vigorous shoots broad-oval, acute or acuminate, more coarsely serrate, $2\frac{1}{2}'$–3′ long, and 2′–$2\frac{1}{2}'$ wide. **Flowers** about $\frac{3}{4}'$ in diameter, on short villose pedicels in compact, many-flowered thick-branched densely villose corymbs; calyx-tube narrowly obconic, tomentose, the lobes narrow, acuminate, finely glandular-serrate, villose; stamens 10; anthers small, pale yellow; styles 5, surrounded at base by a broad ring of hoary tomentum. **Fruit** ripening early in October, on stout pubescent pedicels, in few-fruited spreading or drooping clusters, subglobose or occasionally slightly obovoid, rounded and puberulous at the ends, dull orange-red, marked by large pale dots, about $\frac{1}{2}'$ in diameter; calyx broad, the lobes enlarged, coarsely glandular-serrate, reflexed, often deciduous before the fruit ripens; flesh thin; nutlets 5, prominently ridged on the back with a high rounded ridge, $\frac{1}{4}'$ long.

A tree, 18°–20° high, with a trunk 6′–8′ in diameter, with thin dark brown or nearly black bark separating freely into small plate-like scales, and often armed with thin much-branched spines frequently 7′–8′ long, small erect branches forming a wide open head, and branchlets coated when they first appear with hoary tomentum, dull red-brown, villose or

pubescent during their first season, and furnished with stout straight bright red-brown shining spines 1½′–2′ long.

Distribution. Low rich soil inundated during several weeks in winter, among Oaks and Hickories; near Allenton, St. Louis County, Missouri.

37. Cratægus pratensis Sarg.

Leaves oblong-obovate, acute or rounded at apex, gradually narrowed below from near the middle to the cuneate entire base, sharply and often doubly serrate usually only above the middle with straight or incurved teeth tipped early in the season with a minute dark red caducous gland, and often more or less deeply divided toward the apex into short broad acute lobes, when they unfold bright bronze-yellow or dark red, and covered with short pale hairs, almost smooth and nearly fully grown when the flowers open at the end of May, and at maturity glabrous, thick, dark green and lustrous above, pale below, 1½′–2′ long, and 1′–1½′ wide, with a thin midrib, and 4 or 5 pairs of primary veins extending obliquely toward

Fig. 389

the end of the leaf, and raised and prominent below; petioles slender, glabrous, usually about ½′ in length; leaves at the end of vigorous shoots often oval or broad-ovate, frequently 3′ long and 2½′ wide. **Flowers** ⅓′ in diameter, on long slender pedicels, in broad loose many-flowered corymbs pubescent or puberulous at first but soon glabrous; calyx-tube narrowly obconic, coated toward the base with long matted pale hairs, the lobes narrow, acuminate, coarsely glandular-serrate, glabrous on the outer surface, villose on the inner surface; stamens 10; anthers small, rose color; styles 2 or 3, surrounded at base by a narrow ring of pale tomentum. **Fruit** ripening early in October and remaining on the branches until November, on elongated pedicels, in loose drooping many-fruited clusters, globose, bright scarlet, slightly pruinose, marked by occasional large pale dots, about ⅓′ in diameter; calyx prominent, with much enlarged coarsely glandular-serrate lobes often deciduous before the fruit becomes entirely ripe; flesh thin and yellow; nutlets 2 or 3, thick and broad, about ¼′ long.

A tree, occasionally 20° high, with a tall trunk 3′–7′ in diameter, often armed with long slender much-branched ashy gray spines, spreading branches forming a round-topped symmetrical head, and branchlets occasionally slightly villose when they first appear, soon glabrous, light orange-brown in their first season, and reddish or grayish brown the following year, and furnished with numerous thin straight or slightly curved shining chestnut-brown spines 2′–3′ long.

Distribution. Open woods near the banks of small streams in the prairie region of Stark and Peoria Counties, Illinois.

III. ÆSTIVALES.

CONSPECTUS OF THE ARBORESCENT SPECIES.

Leaves glabrous with the exception of small axillary tufts of pale hairs on the lower surface, oblong-obovate; stamens 15–20; anthers pink or pale rose color. **38. C. æstivalis** (C).

Leaves hoary-tomentose below early in the season, becoming villose with rufous hairs most abundant on the midrib and veins; stamens 20; anthers deep rose color.

Leaves oblong-obovate, acute or broad and rounded at apex, often slightly lobed above the middle, lustrous above; pedicels villose-pubescent. **39. C. rufula** (C).

Leaves elliptic to oblong-cuneiform, narrowed at apex, dull above; pedicels glabrous. **40. C. opaca** (C).

38. Cratægus æstivalis Sarg. May Haw. Apple Haw.

Mespilus æstivalis Walt.

Leaves oblong-obovate, rounded or acute at apex, gradually narrowed and cuneate at base, glabrous with the exception of small axillary tufts of pale hairs, and coarsely crenately serrate above the middle with gland-tipped teeth, beginning to unfold as the flowers open the

Fig. 390

middle of March, and when the fruit ripens at the end of May thin, dark green and lustrous above, yellow-green below, $1\frac{1}{4}'$–$2'$ long, and $\frac{1}{3}'$–$\frac{3}{4}'$ wide, with a slender yellow midrib and obscure primary veins; petioles slender, narrow wing-margined to below the middle, rarely furnished with occasional deciduous glands, about $\frac{1}{4}'$ in length; leaves at the ends of vigorous shoots elliptic to oblong-obovate, acute and usually abruptly short-pointed at apex, concave-cuneate at base, often lobed with one or two lateral lobes. **Flowers** $\frac{3}{4}'$ in diameter, on pedicels about $\frac{1}{3}'$ long, in compact 2 or 3-flowered corymbs; calyx-tube narrowly obconic, glabrous, the lobes gradually narrowed from a broad base, short, entire, without glands, acute or acuminate and often red at apex, persistent and red on the fruit; stamens 15–20; anthers large, pink or pale rose color; styles usually 3. **Fruit** on a short slender erect pedicel, about $\frac{1}{3}'$ long, usually solitary, short-oblong, scarlet, lustrous, about $\frac{1}{3}'$ in length, the calyx persistent with erect lobes; flesh yellow, juicy, acidulous; nutlets usually 3, acute at ends, rounded and slightly ridged on the back, $\frac{1}{4}'$ long.

A slender tree, 20°–25° high, with a tall stem 6′–8′ in diameter, covered with pale flaky bark, erect or slightly spreading branches forming a narrow head, and slender straight or slightly zigzag branchlets chestnut-brown and lustrous during their first season, and dull gray-brown the following year, and armed with stout straight gray spines ½′–1¼′ in length.

Distribution. Low river banks, the borders of swamps and in depressions filled with water during most of the year; banks of the Ogeechee River near Meldrim, Effingham County, and near Valdosta, Lowndes County, Georgia; swamp of the Combahee River near Yemassee, Hampton County, and near Aiken, Aiken County, South Carolina; pond holes eight or nine miles west of Newbern, Craven County, North Carolina; passing into var. *maloides* Sarg. with young leaves tinged with red and villose along the upper side of the midrib, those at the end of vigorous shoots sometimes broad-obovate, rounded and divided at apex into 3 short rounded lobes, longer acuminate calyx-lobes and dark red anthers. Wet prairies, Volusia County, Florida; and into var. *cerasoides* Sarg. differing in the presence of short white hairs on the upper surface of the young leaves, in the longer acuminate calyx-lobes slightly villose on the inner surface and often minutely serrate near the middle, in the dark rose-colored anthers, and the late ripening fruit up to ½′ in diameter, on drooping pedicels often ½′ in length. An arborescent shrub with a round-topped head 30°–40° across, numerous large erect and spreading stems often 30° high, covered with smooth pale bark separating into thin plate-like scales, in falling disclosing the dull red inner bark, and slender nearly straight glabrous branchlets armed with straight slender spines 1′–1½′ in length. **Fruit** ripening late in July and in August. Low, wet, often inundated prairies near Sewall, Volusia County, Bradfordville, Leon County, Jasper, Hamilton County, and Quincy, Gadsden County, Florida. A form of this variety growing in Volusia County (f. *luculenta* Sarg.) differs in the more numerous hairs on the upper surface of the young leaves, in the rather smaller flowers, smaller and less juicy fruit ripening at the end of June or early in July, and in its often arborescent habit.

39. Cratægus rufula Sarg.

Cratægus æstivalis Torr. & Gray in part, not *Mespilus æstivalis* Walt.

Leaves oblong-obovate, acute or rounded at apex, gradually narrowed, cuneate and entire at base, finely crenately glandular-serrate, and often slightly lobed above the middle;

Fig. 391

with short rounded lobes, covered above with soft pale hairs and whitish tomentose below when they unfold, and at maturity thick, dark green, lustrous and glabrous or slightly

pubescent along the midrib on the upper surface, rufous-pubescent especially on the midrib and veins on the lower surface, 1½′–2′ long, and ¾′–1¼′ wide, rarely not more than 1′ long and ½′ wide; petioles slender, villose-pubescent with rufous hairs, occasionally glandular, ¼′–⅓′ in length; leaves at the ends of vigorous shoots oblong-obovate, rounded and short-pointed to elliptic and acuminate, laterally lobed, or deeply 3-lobed at apex, often 2½′ long and 1½′ wide. **Flowers** appearing from the 10th to the end of March, ¾′–1′ in diameter, in mostly 3–5-flowered clusters, on villose-pubescent pedicels about ⅓′ in length; calyx-tube broadly obconic, glabrous or villose-pubescent sometimes in the same cluster, the lobes gradually narrowed from a broad base, acuminate, entire or slightly glandular-serrate nearly to apex, glabrous or slightly pubescent on the outer surface; stamens 20; anthers dark rose color; styles 3–5, surrounded at base by a ring of white tomentum. **Fruit** ripening at the end of May, often solitary on glabrous erect pedicels ¼′–½′ long, subglobose, scarlet, lustrous, about ½′ in diameter, the calyx persistent with erect lobes; nutlets only slightly grooved on the back, about ¼′ long.

A tree, sometimes 30° high, with a tall trunk 8′–10′ in diameter, covered with rough deeply furrowed dark bark, paler and less deeply furrowed on smaller and younger stems, stout ascending and spreading branches forming a broad round-topped head, and slender slightly zigzag branchlets covered when they first appear with pale tomentum, glabrous or rusty tomentose until the early summer, becoming chestnut-brown, lustrous and glabrous before autumn and dull gray in their second year, and unarmed or armed with slender or stout straight spines ½′–1½′ in length.

Distribution. Depressions filled with water except in spring and early summer, sandy borders of ponds and streams and low wet prairies, Cottondale and Round Lake, Jackson County, and Quincy, Gadsden County, Florida; near Bainbridge, Decatur County, and Albany, Dougherty County, Georgia; near Dothan, Houston County, Alabama; pond holes along the Neuse River near Goldsboro, Wayne County, North Carolina.

40. Cratægus opaca Hook.

Cratægus æstivalis Torr. & Gray in part, not *Mespilus æstivalis* Walt.

Leaves elliptic to oblong-cuniform, gradually narrowed and acute or bluntly pointed at apex, cuneate at the often glandular base, finely crenately serrate above the middle with

Fig. 392

minute glandular teeth, pilose above and hoary-tomentose below when they unfold, and at maturity dull dark green and glabrous or slightly hairy on the midrib on the upper surface, pubescent on the lower surface with rusty brown hairs most abundant on the midrib

and veins, 2′–2½′ long, and ½′–1′ wide; petioles slender, villose-pubescent, about ¼′ in length; leaves at the end of vigorous shoots elliptic to oblong-ovate, often irregularly laterally lobed, and 2½′–3′ long and wide. **Flowers** appearing in February and March before or with the unfolding of the leaves, 1′ in diameter, on glabrous pedicels ½′ long, in 3–5-flowered corymbs; calyx-tube broadly obconic, glabrous, the lobes narrowed from a wide base, short, nearly triangular, acute and tipped at apex with a conspicuous gland, entire or minutely serrate, glabrous, often deeply tinged with red; stamens 20; anthers large, deep rose color; styles 3–5, surrounded at base by a broad ring of pale tomentum. **Fruit** ripening early in May, in usually 2–3-fruited clusters, depressed-globose, scarlet, lustrous, dotted with pale spots, ½′–⅔′ in diameter, with a small narrow cavity surrounded by the erect calyx-lobes; nutlets 3–5, rounded at the ends, rounded and slightly grooved on the back, ¼′ long.

A tree, 20°–30° high, with a tall stem occasionally 1° in diameter, covered with deeply fissured bark, divided into dark red-brown persistent scales, slender mostly erect branches forming a narrow round-topped head, and slender branchlets villose-pubescent when they first appear, soon glabrous, lustrous and bright chestnut-brown during their first season, becoming dull gray in their second year, and armed with stout straight chestnut-brown spines ½′–1′ in length, or more often unarmed; occasionally with several stems forming a large shrub.

Distribution. In deep depressions filled with water for most of the year, low river banks and borders of swamps; near Mt. Vernon, Mobile County, and near Selma, Dallas County, Alabama; southern Mississippi (Meridian, Lauderdale County, and Hattiesburg, Forrest County); eastern Louisiana; sometimes in St. Tammany Parish covering large tracts almost to the exclusion of other plants; western Louisiana from the coast to nearly the northern border of the state, and eastern Texas to the valley of the Trinity River; rare and local east of the Mississippi River; common westward. The fruit is largely used in making preserves and jellies.

IV. VIRIDES.

CONSPECTUS OF THE ARBORESCENT SPECIES.

Stamens 20.
- Fruit not exceeding ⅓′ in diameter.
  - Anthers pale yellow.
    - Corymbs, branchlets and leaves glabrous.
      - Bark of the trunk pale gray, close and smooth.
        - Leaves ovate to oblong-obovate, acute or acuminate, rarely rounded at apex; fruit depressed-globose, bright scarlet or orange. **41. C. viridis** (A, C).
        - Leaves ovate, acute, often broadly cuneate at base; fruit subglobose, orange-red. **42. C. ovata** (A).
        - Leaves oval or ovate, acute, rounded or broadly cuneate at base; fruit globose. yellow-green flushed with red. **43. C. vulsa** (C).
      - Bark of the trunk dark brown or nearly black; leaves subcoriaceous.
        - Leaves oblong-ovate to semiorbicular, acute, often short-pointed or rarely rounded at apex; fruit short-oblong to obovoid or globose, dull orange color. **44. C. glabriuscula.**
        - Leaves oval to rhombic, acute or acuminate; fruit subglobose to short-oblong, bright orange-red. **45. C. blanda** (C).
    - Corymbs and branchlets villose-pubescent; leaves ovate or obovate, acute or rounded at apex; fruit subglobose, orange-red. **46. C. velutina** (C).
  - Anthers deep rose color; leaves elliptic to oblong-ovate, acute, acuminate or rarely rounded at apex; fruit globose or subglobose, orange-red. **47. C. arborescens** (C).
- Fruit ¼′–$\frac{5}{16}$′ in diameter.

Anthers yellow.
Leaves cuneate at base; calyx-tube glabrous.
Leaves lanceolate to oblong-obovate, acuminate; fruit short-oblong, dull brick red covered with a glaucous bloom. 48. **C. nitida** (A).
Leaves obovate to oval or rhombic, acute or rarely rounded at apex; fruit subglobose to short-oblong, dark crimson. 49. **C. mitis** (A).
Leaves, broad and rounded at base, ovate, acute; calyx-tube villose; fruit subglobose to short-oblong, dark red. 50. **C. atrorubens** (A).
Anthers rose color; corymbs villose; fruit red.
Leaves obovate, oval or ovate, acute, scabrate above; fruit globose to subglobose, anthers deep rose color. 51. **C. ingens** (C).
Leaves broadly obovate, oval or ovate, acute or acuminate, smooth above; fruit globose or depressed-globose; anthers pale rose color. 52. **C. penita** (C).
Stamens usually 10; occasionally 12–20; anthers bright red; leaves oblong-obovate to oval, usually acute or acuminate; fruit subglobose to short-oblong, bright orange-red. 53. **C. micracantha** (C).

41. Cratægus viridis L.

Cratægus Davisii Sarg.

Leaves ovate to oblong-obovate or oval, acute or acuminate or rarely rounded at apex, gradually narrowed to the cuneate base, finely serrate above with incurved glandular

Fig. 393

teeth, and sometimes slightly 3-lobed toward the apex, tinged with red and slightly hairy above when they unfold, nearly fully grown when the flowers open in April and May, and at maturity membranaceous to subcoriaceous, dark green and lustrous on the upper surface, paler on the lower surface, with large axillary tufts of pale hairs, 1′–2′ long, and ½′–1′ wide, with a thick midrib and conspicuous primary veins; often turning brilliant scarlet late in the autumn before falling; petioles slender, 1′–1½′ in length; leaves at the end of vigorous shoots often deeply laterally lobed with narrow acuminate lobes, and 2½′–4′ long, and 1½′–2′ wide. **Flowers** ¾′ in diameter, on long slender pedicels, in many-flowered corymbs; calyx-tube narrowly obconic, glabrous, the lobes lanceolate, entire; stamens 20; anthers pale yellow; styles 2–5, usually 5, surrounded at base by conspicuous tufts of pale hairs. **Fruit** ripening in the autumn and mostly persistent on the branches through the winter, on long slender pedicels, in drooping many-fruited clusters, depressed-globose, bright scarlet or orange, ⅛′–¼′ in diameter; calyx little enlarged, the lobes often deciduous

from the ripe fruit; nutlets usually 5, narrowed and rounded at the ends, rounded and slightly grooved or ridged on the back, $\frac{1}{16}'$–$\frac{1}{8}'$ long.

A tree, 20°–35° high, with a straight often fluted trunk 8°–12° tall, and 18′–20′ in diameter, covered with close gray or pale orange-colored bark, small branches forming a round rather compact head, and slender glabrous branchlets ashy gray to light red-brown in their first winter, and unarmed or occasionally armed with slender sharp pale spines $\frac{3}{4}'$–1′ long.

Distribution. On the often inundated borders of streams and swamps, rarely in drier ground on low slopes; southeastern Virginia (banks of the Blackwater River near Zuni, Isle of Wight County), North Carolina (Salisbury, Rowan County), South Carolina (near Aiken, Aiken County), eastern Georgia (near Augusta, Richmond County, and Macon, Bibb County), western Florida (River Junction, Gadsden County, and Tallahassee, Leon County to the swamps of the lower Apalachicola River), and westward through central and southern Alabama, southern Mississippi, and Louisiana to the valley of the San Antonio River (Sutherland Springs, Wilson County), Texas, and to central and western Arkansas, eastern Oklahoma and southeastern Missouri (Butler County), southeastern Kansas and northward in the region adjacent to the Mississippi River from Louisiana to northeastern Missouri, and to Pike County, Illinois, ranging eastward in Mississippi to Tishomingo County in the northeastern corner of the state, to northwestern Georgia, southeastern Tennessee, and to Richland County, Illinois; rare and local in the Atlantic and east Gulf states; common and often forming great thickets in western Louisiana, the coast region of eastern Texas, southern Arkansas, and in the region adjacent to the Mississippi River.

42. Cratægus ovata Sarg.

Leaves ovate, acute, broadly or acutely concave-cuneate at the entire base, coarsely often doubly serrate above with glandular teeth, and occasionally slightly divided into

Fig. 394

short lateral lobes, nearly fully grown when the flowers open early in May and then dark green, very smooth and glabrous above with the exception of a few short scattered hairs near the base of the midrib, paler below, with small persistent axillary tufts of white hairs, and at maturity membranaceous, 2′–$2\frac{1}{2}'$ long, and $1\frac{1}{2}'$–2′ wide, with a slender yellow midrib and primary veins; petioles slender, rose-colored in the autumn, about $\frac{3}{4}'$ in length; leaves at the end of vigorous shoots rounded or truncate at the broad base, coarsely serrate, and sometimes 3′ long and wide. **Flowers** about $\frac{1}{2}'$ in diameter, on long slender pedicels, in broad loose many-flowered corymbs; calyx-tube narrowly obconic, glabrous, the lobes broad acute, entire or coarsely glandular-serrate toward the apex, glabrous; styles 5

Fruit ripening in October, on elongated pedicels, in long drooping clusters, subglobose or a little longer than broad, orange-red, $\frac{1}{4}'$–$\frac{5}{16}'$ long; calyx enlarged, with elongated closely appressed lobes sometimes deciduous from the ripe fruit; nutlets 5, acute at the ends, rounded or slightly ridged on the back, about $\frac{3}{16}'$ long.

A tree, 25°–30° high, with a tall trunk sometimes a foot in diameter, covered with smooth gray bark, slender glabrous branchlets light reddish brown and lustrous during their first year, becoming grayish brown in their second season, and unarmed or armed with occasional dark purple slender slightly curved shining spines 1′ long.

Distribution. Low moist soil on the banks of the River Desperes, South St. Louis, St. Louis County, and near Alba, Jasper County, Missouri.

43. Cratægus vulsa Beadl.

Leaves oval or ovate, acute, broad and rounded or broad-cuneate at the entire base, irregularly and often doubly serrate above with straight or incurved gland-tipped teeth, and often divided into several short acute lateral lobes, when they unfold dark bronze-red, and pilose with scattered caducous hairs, and furnished below with tufts of pale often per-

Fig. 395

sistent hairs in the axils of the principal veins, nearly fully grown when the flowers open late in April, and at maturity thin, bright green on the upper surface, paler on the lower surface, about 2′ long and $1\frac{1}{2}'$ wide, with a slender midrib and 4 or 5 pairs of thin pale yellow primary veins; turning in the autumn yellow or brown; petioles slender, somewhat villose at first, soon becoming glabrous, about $\frac{3}{4}'$ in length; leaves at the end of vigorous shoots broadly ovate, acute or acuminate, broad and rounded or occasionally truncate or broadly cuneate at base, more coarsely serrate and more deeply lobed, often 3′ long and $2\frac{1}{2}'$ wide, with a stout winged glandular petiole. **Flowers** $\frac{3}{4}'$ in diameter, on slender pedicels, in compact 3–10-flowered corymbs, with linear acuminate glandular red bracts and bractlets; calyx-tube broadly obconic, glabrous, the lobes gradually narrowed from a broad base, acuminate, entire or occasionally obscurely serrate toward the apex, glabrous; stamens 20; anthers pale yellow; styles 3–5, surrounded at base by a thin ring of pale hairs. **Fruit** ripening at the end of September or early in October, on slender pedicels, in few-fruited drooping clusters, globose, yellow-green flushed with red, $\frac{1}{3}'$ in diameter; calyx prominent, with closely appressed lobes; flesh yellow-green; nutlets 3–5, thin, rounded, sometimes slightly ridged and grooved on the back, about $\frac{3}{16}'$ long.

A tree, occasionally 20° high, with a tall trunk 5′–6′ in diameter, covered with thin fissured bark separating into light gray scales tinged with brown, and often armed with long compound spines, ascending or spreading branches forming an oval usually compact

symmetrical head, and slender nearly straight glabrous chestnut-brown branchlets becoming gray, and armed with thin nearly straight bright chestnut-brown shining spines 1′–1½′ long; sometimes a shrub, with numerous stems.

Distribution. Rich moist soil in the neighborhood of streams; northwestern Georgia and northeastern Alabama.

44. Cratægus glabriuscula Sarg.

Leaves oblong-ovate to semiorbicular, acute or often short-pointed or rarely rounded at apex, gradually narrowed from below the middle to the slender entire base, coarsely and often doubly serrate usually only above the middle with broad straight gland-tipped teeth, and sometimes divided toward the apex into 2 or 3 short acute lobes, nearly fully grown when the flowers open the 1st of April, and then membranaceous and slightly pilose above with scattered hairs most abundant along the base of the midrib, and at maturity subcoriaceous, hard and firm, dark green and lustrous on the upper surface, pale on the lower surface, 1½′–2′ long, and ¾′–1′ wide, with a thin light yellow midrib, and primary

Fig. 396

veins extending obliquely toward the end of the leaf, conspicuous secondary veins and reticulate veinlets; petioles slender, wing-margined, ⅓′ in length; leaves at the end of vigorous shoots often ovate, broadly cuneate at base, much more coarsely serrate, more frequently lobed, 2′–2½′ long and wide. **Flowers** about ½′ in diameter, on long slender pedicels, in few-flowered rather compact corymbs; calyx-tube broadly obconic, glabrous, the lobes short, gradually narrowed from a broad base, entire, villose on the inner surface; stamens 20, anthers nearly white; styles 5. **Fruit** ripening in September and often persistent until late into the winter, on long slender pedicels, in compact many-fruited drooping clusters, short-oblong to obovoid or nearly globose, dull orange color, marked by minute dark dots, about ¼′ long; calyx enlarged, conspicuous, with spreading or closely appressed lobes dull red on the upper side at base, often deciduous before the fruit ripens; flesh very thin, yellow, dry and hard; nutlets 5, rounded and sometimes obscurely grooved on the back, about ⅜′ long.

A tree, 20°–25° high, with a tall straight trunk often a foot in diameter, covered with thin dark brown scaly bark, long ascending branches forming a narrow head, and slender nearly straight branchlets, unarmed or armed with occasional slender straight chestnut-brown lustrous spines ¾′–1′ long.

Distribution. Bottom-lands of the Trinity River and its branches near Dallas, Dallas County, and in Tarrant County, Texas, in forests of Elms and Nettle-trees.

45. Cratægus blanda Sarg.

Leaves oval to rhombic, acute or acuminate, and occasionally slightly lobed toward the apex, broadly cuneate or concave-cuneate at the entire base, coarsely crenately serrate above the middle with gland-tipped teeth, coated with soft pale hairs when they unfold, fully grown when the flowers open about the 1st of May, and then membranaceous, dark green and lustrous above and glabrous below with the exception of large axillary tufts of snow-white tomentum, and at maturity subcoriaceous, yellow-green and lustrous on the upper surface, paler on the lower surface, $1\frac{1}{2}'$–$2'$ long, and $1'$–$1\frac{1}{3}'$ wide, with a slender midrib, and 2 or 3 pairs of thin primary veins extending obliquely toward the end of the leaf;

Fig. 397

petioles slender, at first villose along the upper side, soon becoming glabrous, $\frac{3}{4}'$–$1'$ in length; leaves at the end of vigorous shoots often broadly ovate, rounded at base, more deeply lobed above the middle, $2'$–$2\frac{1}{2}'$ long, and $1\frac{1}{2}'$–$2'$ wide. **Flowers** $1'$ in diameter, on slender elongated pedicels, in broad many-flowered corymbs, with linear entire bracts and bractlets; calyx-tube broadly obconic, glabrous, the lobes gradually narrowed from a broad base, acuminate, entire or obscurely dentate, glabrous; stamens 20; anthers canary-yellow; styles 5. **Fruit** ripening about the middle of October, on slender pedicels, in many-fruited drooping clusters, subglobose to short-oblong, bright orange-red, $\frac{1}{4}'$ in diameter; calyx prominent, with spreading lobes usually deciduous from the ripe fruit; nutlets 5, thin, narrowed at the ends, deeply grooved on the back, $\frac{1}{4}'$ long.

An unarmed tree, 25°–30° high, with a tall trunk $10'$–$12'$ in diameter, covered with dark brown or nearly black bark divided by shallow fissures and broken on the surface into small plate-like scales, stout ascending branches forming a broad irregular head, and nearly straight glabrous branchlets dark orange-green at first, becoming dull red-brown during their first season and darker brown the following year.

Distribution. Dry uplands and low rolling hills: central Arkansas to the valley of the Brazos River, Texas (Columbia and Brazoria), and to Menden, Louisiana, and Selma, Alabama.

46. Cratægus velutina Sarg.

Leaves ovate to obovate, acute or rounded at apex, gradually narrowed and cuneate at the entire base, and sharply often doubly serrate with straight glandular teeth, more than half grown when the flowers open at the end of April and then covered above by short white hairs and below with hoary pubescence, and often furnished with axillary tufts of white tomentum, and at maturity glabrous, smooth and lustrous on the upper surface and covered on the lower surface with matted pale hairs, $1\frac{3}{4}'$–$2'$ long, and $1\frac{1}{2}'$–$2'$ wide, with a thin midrib and primary veins; petioles slender, thickly covered early in the season with

matted hairs, becoming glabrous, ½′–1′ in length; leaves at the end of vigorous shoots ovate, rounded or broad-cuneate at base, coarsely serrate, usually slightly lobed above the middle, and often 2½′–3′ long and 1½′ wide. **Flowers** ½′ in diameter on slender villose pedicels, in usually 7–12-flowered hairy corymbs; calyx-tube narrowly obconic, villose, the lobes gradually narrowed from a broad base, short, acute, entire, slightly villose; stamens 20; anthers yellow; styles 5. **Fruit** on long slender glabrous or nearly glabrous drooping stems in few-fruited clusters, subglobose, orange-red, marked by small pale dots, about ¼′ in diameter; calyx prominent, with a deep narrow cavity pointed in the bottom, and closely

Fig. 398

appressed lobes; flesh thin, dry and mealy; nutlets 5, acute at base, rounded at apex, ridged on the back with a low grooved ridge, about ⅛′ long and ⅛′ wide.

A tree, 20°–25° high, with a trunk 8′–10′ in diameter, covered with dark rough scaly bark, and slender slightly zigzag branchlets, hoary-tomentose when they first appear, light reddish brown, marked by pale lenticels and glabrous or sometimes pubescent near the end in their first autumn, and ashy gray the following year, and armed with slender nearly straight chestnut-brown spines 1′–1½′ in length.

Distribution. Uplands in dry sandy soil, Fulton, Hempstead County, near Texarkana, Bowie County, Arkansas; and in the valley of the lower Brazos River (near Columbia, Brazoria County), Texas, and eastern Louisiana.

47. Cratægus arborescens Ell.

Leaves elliptic to oblong-obovate, acute, acuminate or rarely rounded and abruptly short-pointed and slightly lobed at apex, gradually narrowed cuneate and entire at base, and coarsely doubly serrate above the middle with incurved glandular teeth, villose on the upper side of the midrib with short white hairs when they unfold, and at maturity thin, glabrous, dark green and lustrous on the upper surface, paler and often furnished on the lower surface with small axillary tufts of pale hairs, 1′–2′ long, and ¾′–1′ wide, with a slender midrib and primary veins; petioles slender, glabrous, ½′–1′ in length; leaves at the end of vigorous shoots oval to oblong-ovate or elliptic, acuminate, abruptly or gradually narrowed and cuneate at base, more or less deeply lobed with acuminate lateral lobes, often 2½′ long and 1¼′ wide, their petioles stout, and glabrous early in the season. **Flowers** ½′ in diameter, on slender pedicels, in wide many-flowered compound corymbs; calyx-tube narrowly obconic, glabrous or slightly pilose, the lobes slender, acuminate, entire, glabrous or slightly villose on the inner surface, deciduous from the ripe fruit; stamens 20; anthers

deep rose color; styles usually 5. **Fruit** on short pedicels in many-fruited drooping clusters, globose or subglobose, orange-red, $\frac{1}{4}'$–$\frac{1}{3}'$ in diameter; nutlets 5, pointed at the ends, slightly ridged on the back, about $\frac{1}{6}'$ long.

Fig. 399

A tree, 25°–30° high, with a tall trunk 12′–18′ in diameter covered with close pale gray bark, spreading and erect branches forming a broad rather open irregular head, and slender glabrous red-brown branchlets, ashy gray in their second season, and unarmed or armed with straight slender chestnut-brown spines.

Distribution. River banks, low wet woods and borders of swamps; Georgia-coast region, near Dorchester, Liberty County, in the neighborhood of Savannah, and on the Ogeechee River at Fort Argyle, Chatham County (type station); near Augusta, Richmond County, Georgia.

48. Cratægus nitida Sarg.

Leaves lanceolate to oblong-obovate, acuminate, abruptly or gradually narrowed and cuneate at the entire base, coarsely serrate above with straight or incurved glandular teeth,

Fig. 400

and often more or less divided into 2 or 3 pairs of broad acute lobes, dark red and slightly villose along the upper side of the midrib with scattered caducous hairs when they unfold,

nearly fully grown when the flowers open early in May, and at maturity thick and coriaceous, dark green and very lustrous on the upper surface, pale and dull on the lower surface, 2′–3′ long, and 1′–1½′ wide, with a prominent midrib usually red on the lower side, and few thin prominent primary veins generally extending to the point of the lobes; turning in the autumn rich orange color through shades of bronze and orange-red; petioles stout, glandular, villose while young on the upper side, soon becoming glabrous, ½′–¾′ in length; leaves at the end of vigorous shoots more deeply lobed and frequently 5′ long and 2½′ wide. **Flowers** ¾′ in diameter, on long slender pedicels, in broad compound many-flowered glabrous corymbs; calyx-tube narrowly obconic, glabrous, the lobes slender, elongated, acuminate, entire or sparingly glandular-serrate; stamens 15–20; anthers pale yellow; styles 2–5. **Fruit** ripening at the end of October, on slender elongated pedicels, in many-fruited drooping clusters, short-oblong, full and rounded at the ends, pruinose with a glaucous bloom, marked by small dark dots, ½′–⅝′ long, and about ⅓′ in diameter; calyx only slightly enlarged, the lobes dark red at the base on the upper side, usually erect, often deciduous before the fruit ripens; nutlets 2–5, rounded and ridged on the back with a broad low rounded ridge, light-colored, ¼′ long.

A tree, often 30° high, with a tall straight trunk sometimes 18′ in diameter, covered with close dark bark broken into thick plate-like scales, stout spreading lower branches and erect upper branches forming a broad often irregular head, and slender glabrous branchlets bright orange-brown and lustrous during their first and second seasons, becoming pale reddish brown in their third year, and ultimately ashy gray, and unarmed or armed with occasional straight thin bright chestnut-brown lustrous spines 1′–1½′ long.

Distribution. Bottoms of the Mississippi River, St. Clair County, and to Shawneetown, Gallatin County, Illinois, to Hannibal, Missouri, and in eastern Arkansas to Helena, Phillips County; common.

49. Cratægus mitis Sarg.

Leaves obovate to oval or rhombic, acute or rarely rounded at apex, gradually narrowed and concave-cuneate at the entire base, and coarsely serrate above with straight glandular teeth, nearly fully grown when the flowers open during the first week of May, and then light yellow-green above, paler below, and glabrous with the exception of a few short hairs on the upper side of the midrib, and at maturity subcoriaceous, dark green and lustrous on the upper surface, pale yellow-green on the lower surface, 1½′–2½′ long, and 1′–1½′ wide, with

Fig. 401

a prominent midrib and slender primary veins; petioles stout, wing-margined at apex, occasionally glandular with minute glands, 1⅓′–1½′ in length. **Flowers** ½′–⅝′ in diameter, on long slender pedicels, in compact 8–15-flowered glabrous corymbs, with red glandular bracts

and bractlets; calyx-tube narrowly obconic, glabrous, the lobes glabrous, abruptly narrowed from a broad base, acuminate, finely glandular-serrate below the middle with minute stipitate red glands; stamens 20; anthers yellow; styles 2–4, usually 3. **Fruit** ripening the middle of October, on slender pedicels, in many-fruited drooping clusters, subglobose to short-oblong, rounded at the ends, dark crimson, marked by occasional large dark dots, ½′–⅝′ long, about ½′ in diameter; calyx only slightly enlarged, the lobes serrate, closely appressed, often deciduous from the ripe fruit; flesh thick, pale orange color, and juicy; nutlets usually 3, thick, full and rounded at the ends, prominently ridged on the back, with a broad high rounded deeply grooved ridge, about ¼′ long.

A tree, 25°–30° high, with a tall trunk sometimes a foot in diameter, covered with dark scaly bark, large spreading branches forming a broad round-topped head, and glabrous branchlets dull light reddish brown during their first season, becoming dark brown or ashy gray, and armed with stout straight or slightly curved dull red-brown or purplish spines usually about 1½′ long.

Distribution. Low moist rich soil on the bottoms of the Mississippi River near the village of Cahokia, St. Clair County and Richland County, Illinois.

50. Cratægus atrorubens Ashe.

Leaves ovate, acute, usually rounded or sometimes cuneate or truncate at the broad entire base, coarsely and usually doubly serrate above, and often divided into 2 or 3 pairs

Fig. 402

of short acute lobes, about half grown when the flowers open late in April or early in May and then slightly roughened above by short scattered white hairs, and furnished below with conspicuous axillary tufts of pale tomentum, and at maturity thin, glabrous, dark dull green and smooth on the upper surface, light yellow-green on the lower surface, about 2′ long and 1½′ wide, or on vigorous shoots frequently 3′ long, and 2½′ wide, with a thin midrib and 4 or 5 pairs of slender primary veins; petioles slender, nearly terete, more or less densely villose early in the season, soon becoming glabrous, 1′–1½′ in length. **Flowers** about ⅝′ in diameter, on slender elongated villose pedicels, in broad loose glabrous or villose corymbs; calyx-tube narrowly obconic, densely villose throughout or only at base with pale tomentum, the lobes short, acute, finely glandular-serrate, villose particularly on the inner surface; stamens 20; styles 4 or 5, surrounded at base by a narrow ring of pale tomentum. **Fruit** ripening and falling early in October, on slender pedicels, in drooping few-fruited clusters, subglobose to short-oblong, rounded at the ends, dark red; calyx somewhat enlarged, with spreading lobes usually deciduous before the fruit ripens; nutlets 4 or 5, thin, rounded and sometimes obscurely grooved on the back, about ⅜′ long.

A tree, sometimes 30° high, with a tall trunk 12′–18′ in diameter, covered with dark red-brown scaly bark, thin erect and spreading branches forming a compact rather narrow head, and slender glabrous branchlets marked by occasional dark lenticels, dark green more or less tinged with red when they first appear, soon becoming dark chestnut-brown and very lustrous, and bright reddish brown in their second year, and usually unarmed.

Distribution. St. Louis County, Missouri, and rich bottom-lands of the Mississippi River, St. Clair County, Illinois; not common.

51. Cratægus ingens Beadl.

Leaves obovate-oval or ovate, broadly or acutely cuneate at the entire base, crenately serrate above, and often slightly lobed toward the acute apex, about half grown when the flowers open at the end of April or early in May and then roughened above by short rigid hairs and villose below along the midrib, and the remote slender veins extending obliquely

Fig. 403

to the point of the lobes, and at maturity subcoriaceous, dark green and scabrate on the upper surface, paler and nearly glabrous on the lower surface, 1½′–2′ long, and 1¼′–1½′ wide; turning in the autumn yellow, orange, red, or brown; petioles stout, narrowly wing-margined to the middle, pubescent while young, becoming glabrous, about ¾′ in length; leaves at the end of vigorous shoots more deeply lobed and often 3′–3½′ long, and 2′ wide, with a stout broad-winged petiole sometimes 1½′ long. **Flowers** ½′–⅝′ in diameter, on slender hairy pedicels, in many-flowered compact hairy corymbs; calyx narrowly obconic, coated, especially toward the base with matted pale hairs, the lobes slender, elongated, acute, glandular with bright red glands, glabrous on the outer, sparingly villose on the inner surface; stamens 20; anthers deep rose color; styles 3–5. **Fruit** ripening in October, on stout puberulous pedicels, in few-fruited drooping clusters, globose to subglobose, red, about ⅜′ in diameter; calyx little enlarged, with reflexed appressed nearly glabrous lobes; nutlets 3–5, rounded or slightly grooved and ridged on the back, ¼′ long.

A tree, sometimes 25° high, with a trunk a foot in diameter, spreading branches forming a wide round-topped head, and unarmed branchlets covered at first with matted pale hairs, soon becoming glabrous, dark chestnut-brown.

Distribution. Moist woods and the low banks of streams; southeastern Tennessee and northwestern Georgia.

52. Cratægus penita Beadl.

Leaves broad-obovate, oval, or ovate, acute or acuminate at apex, broadly or acutely concave-cuneate at the entire base, sharply often doubly serrate above with glandular

mostly straight teeth, and often slightly lobed above the middle, deeply tinged with red and covered with pale hairs when they unfold, nearly fully grown when the flowers open about the 1st of May and then smooth above, and glabrous below with the exception of axillary tufts of pale hairs, and at maturity subcoriaceous, dark green and lustrous on the upper surface, paler on the lower surface, $1\frac{3}{4}'$–$2'$ long, and $1'$–$1\frac{3}{4}'$ wide, with a prominent midrib and slender primary veins; turning orange, yellow, and brown in the autumn; petioles slender, covered while young like the upper side of the base of the midrib with pale decid-

Fig. 404

uous hairs, $\frac{1}{2}'$–$\frac{3}{4}'$ in length; leaves at the end of vigorous shoots often rounded or subcordate at base, more or less deeply lobed, and $2\frac{1}{2}'$–$3'$ long and broad, with a stout broadly winged glandular petiole. **Flowers** about $\frac{5}{8}'$ in diameter, on elongated glabrous or sparingly hairy pedicels, in compact few-flowered nearly glabrous corymbs; calyx broadly obconic, glabrous, the lobes gradually narrowed from a broad base, slender, acuminate, entire, or furnished with occasional minute glandular teeth, slightly villose on the inner surface; stamens 20; anthers white faintly tinged with pink; styles 3–5. **Fruit** ripening in October, on elongated slender pedicels, in few-fruited drooping clusters, globose or depressed-globose, red, about $\frac{1}{4}'$ in diameter; calyx enlarged, with spreading or reflexed lobes villose on the upper side; nutlets 3–5, narrowed and acute at the ends, rounded and broadly grooved on the back, about $\frac{1}{4}'$ long.

A tree, 18°–20° high, with a short trunk sometimes $10'$ in diameter, stout ascending or spreading branches forming a wide head, unarmed branchlets puberulous while young, soon glabrous, becoming light reddish brown.

Distribution. Low moist woods and the banks of streams; southeastern Tennessee.

53. Cratægus micracantha Sarg.

Leaves oblong-obovate to oval, acute, acuminate, or rarely rounded at apex, gradually or abruptly narrowed from above or from below the middle to the cuneate entire base, coarsely crenulate-serrate, and occasionally 3-lobed above with short broad acute lateral lobes, when they unfold villose on the upper and hoary-tomentose on the lower surface, more than half grown when the flowers open about the middle of May and then membranaceous and slightly villose above with short scattered pale hairs, and at maturity thin but firm in texture, dark yellow-green, lustrous and smooth above, paler and tomentose below on the slender midrib and 3 or 4 pairs of very obscure primary veins, $2'$–$2\frac{1}{2}'$ long, and $1'$–$1\frac{1}{4}'$ wide; petioles slender, tomentose early in the season, becoming glabrous or pubescent, $\frac{1}{2}'$–$1'$ in length; leaves at the end of vigorous shoots often broadly rhombic to obovate, acuminate, frequently deeply 3-lobed or divided into 2 or 3 pairs of short lateral lobes, usually $2\frac{1}{2}'$–$3'$ long.

Flowers cup-shaped, $\frac{1}{4}'$ in diameter, on long slender pedicels thickly coated with matted white hairs, in broad lax many-flowered compound hairy corymbs; calyx-tube narrowly obconic, villose, the lobes linear, acuminate, entire, slightly villose, tipped with minute dark glands; stamens usually 10, occasionally 12, 15, or 20; anthers small, deep bright red; styles 5. **Fruit** ripening the middle of October, on slender pubescent pedicels, in drooping many-fruited clusters, subglobose to short-oblong, full and rounded at the ends, bright orange-red, lustrous, marked by occasional large pale dots, about $\frac{1}{4}'$ long; calyx prominent,

Fig. 405

with a short villose tube, and spreading erect hairy lobes often deciduous from the ripe fruit; nutlets 5, thin, acute at the narrow ends, rounded and sometimes slightly grooved on the back, about $\frac{3}{16}'$ long.

An unarmed tree, sometimes 25° high, with a tall trunk 8′–12′ in diameter, covered with light or dark brown bark separating freely into thin narrow scales, stout spreading branches forming a broad flat-topped handsome head, and slender nearly straight branchlets coated until after the flowering time with thick hoary tomentum, bright red-brown and puberulous during their first season, becoming light or dark dull reddish brown the following year.

Distribution. Common in low woods in rich moist soil near Fulton, Hempstead County, Arkansas.

V. PRUINOSÆ.

CONSPECTUS OF THE ARBORESCENT SPECIES.

Stamens 20.

Anthers rose color.

Leaves elliptic; fruit subglobose, green and pruinose when fully grown, becoming dark purple-red and very lustrous; anthers large, deep rose color. 54. **C. pruinosa** (A, C).

Leaves ovate, acute or acuminate; fruit short-oblong, dull russet-green; anthers small, light rose color. 55. **C. georgiana** (C).

Anthers white; leaves ovate, acute, cordate at base; fruit broader than high, scarlet, pruinose, becoming lustrous. 56. **C. callicarpa** (A).

Stamens 10; anthers dark rose color; leaves broad-ovate, acuminate; fruit subglobose, green more or less tinged with red, pruinose. 57. **C. disjuncta** (A.)

54. Cratægus pruinosa K. Koch.

Leaves elliptic, acute, broadly or acutely cuneate at the entire base, irregularly and often doubly serrate above with glandular straight or incurved teeth, and divided in 3 or 4 pairs

of short acute or acuminate lateral lobes, when they unfold bright red and glabrous with the exception of a few short caducous hairs on the upper side of the base of the midrib, nearly fully grown when the flowers open from the middle to the end of May and then membranaceous and bluish green, and at maturity subcoriaceous, dark blue-green and often glaucous above, pale below, 1′–1½′ long, and ¾′–1′ wide, with a slender midrib, and 3 or 4 pairs of thin primary veins running to the point of the lobes; late in the autumn turning dull orange color; petioles slender, glandular, slightly winged at the apex, often bright red in early spring and in the autumn, 1′–1½′ in length; leaves at the end of vigorous shoots broad-ovate, often rounded at base, more coarsely serrate and more deeply lobed, frequently 2½′ long and wide, with stouter and more broadly winged petioles. **Flowers** ¾′–1′ in diameter, on long slender pedicels, in few-flowered glabrous corymbs; calyx-tube broadly obconic, glabrous, the lobes gradually narrowed from a wide base, long-pointed, finely glandular-serrate below the middle; stamens 20; anthers large, deep rose color; styles 5,

Fig. 406

surrounded at base by a thick ring of hoary tomentum. **Fruit** on long thin light green ultimately bright red pedicels, in few-fruited drooping clusters, 5-angled, apple green and covered with a glaucous bloom until nearly fully ripe, at maturity late in October subglobose but rather broader than high, barely angled, ½′–⅝′ in diameter, dark purple-red, marked by many small dull dots, very lustrous; calyx prominent, with a long well-developed tube, and enlarged usually erect lobes often deciduous before the fruit ripens; flesh thick, light yellow; nutlets 5, light-colored, acute at apex, nprrowed and rounded at base, deeply grooved on the back, ¼′ long.

A tree, 15°–20° high, with a stem a few inches in diameter, spreading horizontal branches forming a broad open irregular head, and slender glabrous branchlets bright chestnut-brown during their first season, later becoming dark reddish brown, and armed with numerous stout straight light chestnut-brown spines 1′–1½′ long; often shrubby, with several intricately branched stems.

Distribution. Slopes of low hills often in limestone soil; southwestern Vermont, westward through New York to southern Ontario (neighborhood of Toronto), and through Ohio and Indiana to central and northern Illinois, and southward through eastern Pennsylvania to northern Delaware.

55. Cratægus georgiana Sarg.

Leaves ovate, acute or acuminate at apex, rounded or broad-cuneate at base, finely and often doubly serrate with straight or incurved gland-tipped teeth, and divided into

numerous short acute lateral lobes, glabrous with the exception of a few pale caducous hairs on the upper surface and bronze-yellow when they unfold, nearly half grown when the flowers open about the 20th of April and then thin, dark yellow-green above and pale below, and at maturity thin but firm in texture, dark blue-green on the upper surface, pale on the lower surface, $1\frac{1}{2}'$–$2'$ long, and $1'$–$1\frac{1}{4}'$ wide, with a slender yellow midrib and 3 or 4 pairs of thin primary veins; petioles slender, often short-winged at the apex, usually about $\frac{3}{4}'$ in length; leaves at the end of vigorous shoots often $3'$ long and $2'$ wide, sometimes deltoid and usually much more deeply lobed. **Flowers** $\frac{3}{4}'$ in diameter, on slender pedicels, in usually 5–7-flowered compact glabrous corymbs; calyx-tube broadly obconic, glabrous, the lobes gradually narrowed from a broad base, acuminate, entire or obscurely and irregularly serrate, glabrous; stamens 20; anthers small; light rose color; styles 5; surrounded at the base by a narrow ring of pale tomentum. **Fruit** ripening and falling early in October, on slender pedicels, in drooping few-fruited clusters, short-oblong, full and rounded at the

Fig. 407

ends, often obscurely 5-angled, dull russet-green, $\frac{3}{8}'$–$\frac{1}{2}'$ long; calyx-lobes only slightly enlarged, mostly deciduous before the fruit ripens, leaving a well-defined ring at the summit of the short calyx-tube; flesh thin, light green; nutlets 5, thin, rounded and irregularly grooved on the back, about $\frac{1}{4}'$ long.

A tree, sometimes 25°–30° high, with a tall trunk $10'$–$12'$ in diameter, stout wide-spreading branches forming a broad symmetrical round-topped head, and slender lustrous chestnut-brown branchlets armed with straight or slightly curved thin spines rarely more than $1\frac{1}{2}'$ long.

Distribution. Low rich river-bottoms and meadows in the neighborhood of Rome, Floyd County, Georgia.

56. Cratægus callicarpa Sarg.

Leaves ovate, acute, cordate at base, coarsely often doubly serrate with long straight glandular teeth, and slightly divided into 3 or 4 pairs of short broad acuminate lateral lobes, not more than a quarter grown when the flowers open late in April and then very thin, yellow-green and slightly villose above and on the midrib below, and at maturity thin, glabrous, dark yellow-green and lustrous on the upper surface, pale yellow-green on the lower surface, $4'$–$4\frac{1}{2}'$ long, and $2'$–$2\frac{1}{2}'$ wide, with a stout midrib, and 3 or 4 pairs of prominent primary veins connected by conspicuous cross veinlets; petioles stout, slightly wing-margined at apex, sparingly glandular, $1'$–$1\frac{1}{4}'$ in length; leaves at the end of vigorous shoots thicker, with shorter glandular petioles rose-colored toward the base. **Flowers** $1'$ in diameter, on short stout pedicels, in small compact 5–10-flowered corymbs, with lanceolate to

linear-obovate glandular bracts and bractlets usually persistent until the flowers open; calyx-tube broadly obconic, glabrous, the lobes separated by wide sinuses, short, broad, acuminate, coarsely glandular-serrate, slightly villose on the inner surface; stamens 20; anthers white; styles 5, surrounded at base by a broad ring of pale tomentum. **Fruit** ripening early in October on short stout spreading pedicels in 2 or 3-fruited clusters, broader than high, distinctly 5-angled, rounded at the wide apex, truncate at base, with a deep depression at the insertion of the pedicel, scarlet, pruinose, becoming lustrous, marked by numerous large pale dots, $\frac{3}{4}'$–$\frac{4}{5}'$ broad, and about $\frac{3}{4}'$ high; calyx-lobes deciduous; flesh thin, light yellow slightly tinged with red, remaining on the ground through the winter without becoming soft; nutlets 5, thin, acute at apex, rounded at base, rounded and slightly grooved or ridged with a low grooved ridge on the back, $\frac{1}{5}'$–$\frac{1}{4}'$ long and wide.

Fig. 408

A tree, 20°–25° high, with a tall stem 5′–6′ in diameter covered with dark scaly bark, and stout nearly straight branchlets dark orange-green when they first appear, becoming light chestnut-brown, lustrous and marked by small pale lenticels in their first season, and dull reddish brown the following year, and armed with stout straight or slightly curved purplish spines 1′–$1\frac{1}{2}'$ in length.

Distribution. Rich hillsides, near Shrewsbury, St. Louis County, Missouri.

57. Cratægus disjuncta Sarg.

Leaves broad-ovate, acuminate, full and rounded or concave cuneate at the entire base, sharply often doubly serrate above with straight or incurved glandular teeth, and slightly and irregularly divided above the middle into narrow acuminate spreading lobes, thin, glabrous, dark blue-green above, pale below, $2\frac{1}{2}'$–3′ long, and $2\frac{1}{4}'$–$2\frac{1}{2}'$ wide, with a slender yellow midrib, and 4 or 5 pairs of thin primary veins extending obliquely to the point of the lobes; petioles slender, wing-margined at apex, glandular, 1′–$1\frac{1}{4}'$ in length. **Flowers** opening the first of May, $\frac{2}{3}'$ in diameter, on long stout pedicels, in glabrous compact 3–6 usually 5-flowered glabrous corymbs, with conspicuous glandular early deciduous bracts and bractlets; calyx-tube narrowly obconic, glabrous, the lobes slender, acuminate, glabrous, entire or sparingly glandular-serrate; stamens 10; anthers large, dark rose color; styles 4 or 5, surrounded at base by a narrow ring of pale tomentum. **Fruit** on stout rigid pedicels, in drooping or spreading clusters, subglobose, usually rather broader than high, angled, green more or less tinged with red, pruinose, $\frac{1}{2}'$–$\frac{3}{4}'$ in diameter; calyx prominent, with a short tube and much enlarged spreading or erect lobes usually deciduous at midsummer; flesh thin, greenish yellow; nutlets usually 4, rounded at the ends, deeply grooved on the back, about $\frac{1}{4}'$ long.

A tree, 15°–18° high, with a tall slender trunk, covered with dark slightly scaly bark, small

erect and spreading branches forming an open irregular head, and stout slightly zigzag glabrous branchlets dark olive-green tinged with red when they first appear, dark dull red-

Fig. 409

dish brown or purple and marked by small pale lenticels at the end of their first season, becoming light grayish brown in their second year, and armed with numerous stout nearly straight dark purple lustrous spines $2\frac{1}{2}'$–$3'$ in length.

Distribution. Gravelly banks of small streams near Monteer, Shannon County, and at Carl Junction, Jasper County, Missouri, and to Heber Springs, Cleburne County, and Fayetteville, Washington County, Arkansas.

VI. SILVICOLÆ.

Medioximæ Sarg.

CONSPECTUS OF THE ARBORESCENT SPECIES.

Fruit on short erect pedicels; leaves rounded or occasionally slightly cordate at base.
58. **C. drymophila** (C).

Fruit on elongated drooping pedicels.
Leaves truncate, cordate or rounded at base; anthers, pale rose. 59. **C. diffusa** (A).
Leaves cuneate or rounded at base; anthers, dark purple. 60. **C. luxuriosa** (A).

58. Cratægus drymophila Sarg.

Cratægus silvicola Beadl.

Leaves ovate, acute or acuminate at apex, rounded at the entire base, sharply and often doubly serrate above with gland-tipped teeth, and slightly and irregularly divided into short acute lateral lobes, when they unfold dark red and coated with short soft pale hairs most abundant on the upper surface, about half grown when the flowers open at the end of April and then nearly glabrous, and at maturity thin, dark yellow-green and smooth or scabrate above, pale and glabrous below, or occasionally villose along the under side of the slender midrib, and of 3 or 4 pairs of thin primary veins extending to the point of the lobes, about $2'$ long and $1\frac{1}{2}'$–$1\frac{3}{4}'$ wide; petioles slender, glandular, about $1'$ in length; leaves at the end of vigorous shoots often deltoid, truncate or cordate at base, more coarsely serrate, more deeply lobed, and often $2\frac{1}{2}'$ long and wide. **Flowers** about $\frac{3}{4}'$ in diameter, on slender pedicels, in compact few-flowered thin-branched glabrous corymbs, with linear glandular bright red caducous bracts and bractlets; calyx-tube narrowly obconic, glabrous, the lobes gradually narrowed, acuminate, glabrous, entire or glandular-serrate; stamens 10; anthers large, dark rose color; styles 3–5, surrounded at base by a narrow ring of pale hairs. **Fruit** ripening at the end of September and soon falling, on short pedicels, in erect few-fruited clusters, subglobose and often a little broader than long, red or greenish yellow, with a rosy

cheek, about $\frac{1}{2}'$ in diameter; calyx little enlarged, with spreading lobes usually deciduous before the fruit ripens; flesh thin and yellow; nutlets 3–5, about $\frac{1}{4}'$ long.

A tree, sometimes 30° high, with a tall straight trunk 6′–8′ in diameter, covered with close or slightly fissured bark broken into small gray or red-brown scales, and often armed with long stout branched gray spines, ascending or spreading branches forming a narrow irregular or round-topped head, and slender branchlets dark green tinged with red and covered with long pale scattered white hairs when they first appear, soon becoming gla-

Fig. 410

brous, bright red-brown during their first year, and ultimately ashy gray, and armed with few or many thin straight or somewhat curved bright chestnut-brown spines $1\frac{1}{2}'$–2′ long; or in dry soil of upland forests usually a shrub, with numerous stems.

Distribution. Low moist flat woods; northern Alabama and northwestern and central Georgia, and occasionally on the drier uplands of the surrounding country; common; central Mississippi (Pelahatchee, Rankin County; Jackson, Hinds County, and in Franklin County); eastern Louisiana (Holtsville, St. Tammany Parish, anthers pink, *R. S. Cocks*).

59. Cratægus diffusa Sarg.

Cratægus Beckwithæ Sarg.

Cratægus Robbinsiana Sarg.

Leaves ovate, acute or acuminate at apex, rounded, truncate or cordate at the entire base, often doubly serrate above with straight glandular teeth, and more or less deeply divided into 4 or 5 pairs of spreading acuminate lateral lobes, deeply-tinged with red, glabrous below and covered above with short white hairs when they unfold, nearly fully grown when the flowers open from the middle to the 20th of May and then thin, pale yellow-green and hairy above and pale below, and at maturity thin and firm, smooth, dark green and glabrous on the upper surface, pale on the lower surface, $1\frac{1}{4}'$–2′ long, and 1′–$1\frac{1}{2}'$ wide, with a slender yellow midrib, and thin primary veins extending obliquely to the point of the lobes; often turning orange color tinged with red in the autumn; petioles slender, slightly wing-margined at apex, glandular with minute stipitate dark glands, $\frac{1}{2}'$–$\frac{3}{4}'$ in length; leaves at the end of vigorous shoots broad-ovate, usually long-pointed, cordate or rarely truncate at base, more coarsely serrate, more deeply lobed, and frequently $2\frac{1}{2}'$–3′ long, and 2′–$2\frac{1}{2}'$ wide, with a stout reddish conspicuously glandular petiole $\frac{2}{5}'$–$\frac{3}{5}'$ in length. **Flowers** $\frac{1}{2}'$–$\frac{3}{5}'$ in diameter, on slender glabrous pedicels, in 6–10-flowered corymbs, with linear glandular bracts and bractlets mostly deciduous before the flowers open; calyx-tube broadly obconic, glabrous, the lobes gradually narrowed from a wide base, acuminate at the gland-tipped

apex, entire or slightly and irregularly toothed near the middle; stamens 7–10; anthers light rose color; styles 4 or 5, surrounded at base by a ring of pale tomentum. **Fruit** ripening from the first to the middle of October, on slender pedicels, in few-fruited erect clusters, depressed-globose, rather broader than high, dull red and slightly pruinose, becoming lustrous, and about $\frac{1}{2}'$ in diameter; calyx little enlarged, with spreading appressed lobes bright red on the upper side below the middle and mostly persistent on the ripe fruit; flesh thin, hard, greenish white; nutlets 4 or 5, broad and rounded at base, narrowed and rounded at apex, ridged on the back with a high ridge, about $\frac{1}{4}'$ long.

A tree, occasionally 30° high with a tall trunk 8′–10′ in diameter, covered with light gray closely appressed scales, comparatively small erect branches forming an open head, and

Fig. 411

slender slightly zigzag branchlets marked by numerous dark lenticels, green tinged with red and glabrous when they first appear, bright chestnut-brown and lustrous during their first winter, and pale gray-brown the following year, and armed with numerous slender or occasionally stout nearly straight bright red-brown shining spines $1\frac{1}{4}'$–$1\frac{1}{2}'$ long; usually smaller and sometimes a shrub.

Distribution. Valley of the Connecticut River (Walpole, Cheshire County, New Hampshire, and Westminster and Putney, Windham County, Vermont), western Vermont (near Burlington, Chittenden County); eastern, central and western New York; common.

60. Cratægus luxuriosa Sarg.

Leaves oblong-ovate, acuminate, gradually narrowed and cuneate or rounded at the often unsymmetrical base, finely often doubly serrate with straight glandular teeth, and slightly divided usually only above the middle into 3 or 4 pairs of small acute lobes, about half grown when the flowers open late in May and then thin, dark yellow-green and roughened above by short white hairs and paler below, and at maturity thin, dark yellow-green and scabrate on the upper surface, pale bluish green on the lower surface, $2\frac{1}{4}'$–$2\frac{1}{2}'$ long, and $1\frac{3}{4}'$–$2'$ wide, with a slender midrib and obscure primary veins; petioles slender, slightly wing-margined at apex, occasionally glandular with minute persistent glands, $1'$–$1\frac{1}{4}'$ in length; leaves at the end of vigorous shoots broad-ovate, rounded at base, coarsely serrate, laterally lobed with numerous short broad lobes, often $3'$ long and $2\frac{1}{2}'$ wide. **Flowers** $\frac{3}{4}'$ in diameter, on short slender pedicels, in compact mostly 6–12-flowered corymbs; calyx-tube narrowly obconic, the lobes long, slender, acuminate, entire or occasionally

slightly dentate near the middle, glabrous on the outer surface, slightly villose on the inner surface; stamens 8–10; anthers bright purple; styles 3–5. **Fruit** ripening and beginning to fall early in October, on short stout pedicels, in drooping usually 1–3-fruited clusters, subglobose to slightly obovoid, scarlet, lustrous, marked by pale dots, $\frac{1}{2}'$–$\frac{3}{4}'$ in diameter; calyx little enlarged, with a deep narrow cavity and spreading and incurved usually persistent lobes dark red on the upper side below the middle; flesh thick, yellow-green and acid; nutlets 3–5, usually 4, gradually narrowed and rounded at the ends, ridged on the back with a broad high grooved ridge, about $\frac{1}{4}'$ long.

An oval-headed tree, 20°–30° high, with a short trunk sometimes 8′–10′ in diameter,

Fig. 412

covered with dark gray scaly bark, and stout zigzag often contorted branchlets dark orange-green and marked by large pale lenticels when they first appear, becoming light chestnut-brown and lustrous in their first season and dull red-brown the following year, and armed with few stout slightly curved chestnut-brown shining spines 1′–$1\frac{1}{2}'$ long, persistent and becoming branched on old stems.

Distribution. Rich hillsides, Kittanning, Armstrong County, and on the flood plain of the Allegheny River at Whiskey Hollow across the river from Kittanning, and Linesville, Crawford County, Pennsylvania.

VII. TENUIFOLIÆ.

CONSPECTUS OF THE ARBORESCENT SPECIES.

Stamens 5–10.

Corymbs villose.

Leaves oblong-ovate; stamens usually 5; anthers pink; fruit obovoid to short-oblong. 61. **C. apiomorpha** (A).

Leaves oblong-obovate; stamens 10; anthers reddish purple; fruit obovoid to subglobose. 62. **C. paucispina** (A).

Corymbs glabrous; leaves oval or ovate; stamens usually 5; anthers dark reddish purple; fruit short-oblong. 63. **C. pentandra** (A).

Stamens usually 20.

Corymbs villose.

Leaves broad-ovate to obovate or rarely oval; fruit short-oblong to obovoid. 64. **C. lucorum** (A).

Leaves rhombic to broad-ovate or rarely obovate; fruit ellipsoidal. 65. **C. lacera** (C).

Corymbs glabrous.

Leaves ovate; anthers pale rose color; fruit subglobose to broad-obovoid, dark red. 66. **C. depilis** (A).

Leaves ovate; stamens 15–20; anthers dark rose color; fruit subglobose. 67. **C. basilica** (A).

61. Cratægus apiomorpha Sarg.

Leaves oblong-ovate, acuminate, rounded or rarely cuneate at the entire often unsymmetrical base, finely doubly serrate above with slender glandular teeth, and slightly divided above the middle into 4 or 5 pairs of triangular acute lobes, about half grown when the flowers open early in May and then membranaceous, light yellow-green and tinged with red or bronze color, and covered above with short white hairs and pale and glabrous below, and at maturity thick and firm in texture, dark blue-green and smooth and lustrous or

Fig. 413

sometimes dull and scabrate on the upper surface, pale blue-green on the lower surface, $1\frac{1}{2}'$–$2\frac{1}{4}'$ long, and $1\frac{1}{8}'$–$1\frac{1}{2}'$ wide, with a stout midrib, and primary veins arching obliquely to the point of the lobes; petioles slender, slightly winged at the apex, often sparingly glandular, $\frac{3}{8}'$–$1'$ in length; leaves at the end of vigorous shoots often 3′ long. **Flowers** $\frac{1}{2}'$–$\frac{3}{4}'$ in diameter, on short villose or glabrous pedicels, in compact many-flowered usually hairy corymbs, their bracts and bractlets linear to oblong-obovate, glandular-serrate with stipitate dark red or purple glands, turning red before falling, mostly persistent until after the flowers open; calyx-tube narrowly obconic, glabrous, the lobes abruptly narrowed at base, slender, acuminate, entire or sparingly glandular; stamens 5–10, usually 5; anthers pink; styles 3–5, surrounded at base by tufts of pale hairs. **Fruit** ripening early in September and soon falling, on slender pedicels, in few-fruited drooping clusters, obovoid or rarely short-oblong, bright reddish purple, marked by small scattered pale dots, $\frac{3}{8}'$–$\frac{5}{8}'$ long, and $\frac{1}{4}'$–$\frac{1}{3}'$ in diameter; calyx much enlarged, with spreading lobes, their tips mostly deciduous from the ripe fruit; flesh thin, yellow, juicy, pleasantly acid; nutlets 3–5, thin, rounded and ridged on the back with a low ridge, about $\frac{1}{4}'$ long.

A tree, sometimes 25° high, with a trunk 6′ in diameter and 3°–6° long, covered with dark gray bark separating into thin plates, in falling disclosing the yellow inner bark, numerous ascending branches forming an oblong or pyramidal crown, and slender branchlets dark dull red-brown during their first season, becoming dark gray-brown the following year, and unarmed, or armed with slender nearly straight dull red-brown ultimately ashy gray spines $1'$–$1\frac{1}{2}'$ long; or often shrubby, with numerous stems spreading into small clumps.

Distribution. Dry open places, borders of woods, and the margins of the high banks of streams; common and generally distributed in northeastern Illinois.

62. Cratægus paucispina Sarg.

Leaves oblong-obovate, acuminate, rounded, concave-cuneate to truncate or subcordate at the entire base, sharply doubly serrate above with straight glandular teeth, and deeply divided into 4 or 5 pairs of acute lateral lobes spreading or pointing toward the apex of the leaf, about half grown when the flowers open early in May and then light yellow-green and slightly roughened above by short white hairs and paler and glabrous below, and at maturity membranaceous, dark blue-green and scabrate on the upper surface, pale blue-green on the lower surface, $2\frac{1}{2}'$–$3'$ long, and $1\frac{1}{2}'$–$2\frac{1}{2}'$ wide, with a slender yellow midrib, and thin primary veins extending obliquely to the point of the lobes; petioles slender, usually without glands, tinged with purple in the autumn, $\frac{3}{4}'$–$1\frac{1}{2}'$ in length. **Flowers** $\frac{5}{8}'$–$\frac{3}{4}'$ in diameter, on slender hairy pedicels, in broad 12–20-flowered slightly villose corymbs, their bracts and bractlets linear to oblong-obovate, glandular, red, mostly persistent until after the flowers

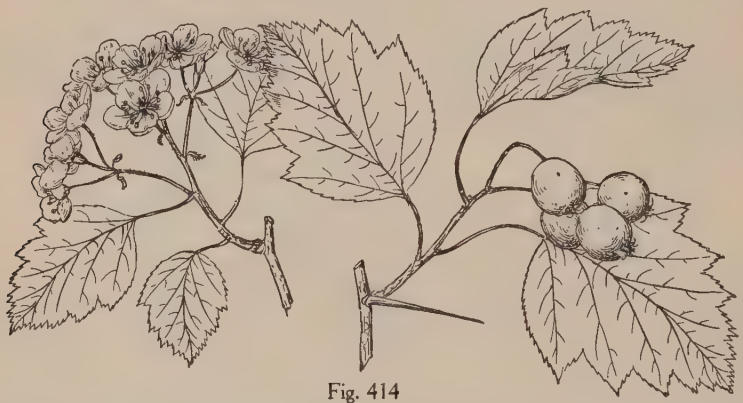

Fig. 414

open; calyx-tube narrowly obconic, glabrous, the lobes narrow, acuminate, glandular-serrate with small dark red stipitate glands, glabrous on the outer, pubescent on the inner surface; stamens 10; anthers bright reddish purple; styles 4 or 5, surrounded at base by tufts of pale hairs. **Fruit** ripening during the first half of September and soon falling, on slender glabrous pedicels, in drooping clusters, obovoid to subglobose, crimson or purplish, marked by numerous small pale dots, slightly pruinose, $\frac{1}{2}'$–$\frac{5}{8}'$ long, and about $\frac{1}{2}'$ in diameter; calyx small, with reflexed and appressed or erect and incurved serrate lobes dark red on the upper side below the middle, often deciduous from the ripe fruit; flesh thin, yellow, juicy, acid and edible; nutlets 4 or 5, thin, narrowed and acute at the ends, rounded and slightly grooved or obscurely ridged on the back, about $\frac{1}{4}'$ long.

A tree, sometimes 25° high, with a trunk $4'$–$6'$ in diameter and often 6° long, covered with dark gray or nearly black bark separating into thin plate-like scales, numerous branches forming a round-topped head, and slender glabrous branchlets dark yellow-green when they first appear, becoming dark reddish brown at the end of their first season, olive-green in their second year, and ultimately dark gray-brown, and armed with small straight light red-brown shining spines $\frac{1}{2}'$–$\frac{3}{4}'$ long.

Distribution. Woods and river banks in dry clay soil; northeastern Illinois; common.

63. Cratægus pentandra Sarg.

Leaves oval or ovate, acuminate, broadly cuneate or rarely rounded at the entire base, divided above the middle into numerous short acute or acuminate lobes, and coarsely and

often doubly serrate with straight or incurved teeth tipped with small dark glands, nearly fully grown and very thin when the flowers open at the end of May, and at maturity membranaceous, dark green and roughened above by short rigid pale hairs, pale and glabrous below, 2′–2½′ long, and 1½′–2′ wide, with a slender yellow midrib, and thin primary veins extending to the point of the lobes; petioles slender, often winged toward the apex, glandular with minute dark glands, usually about 1′ in length; leaves at the end of vigorous shoots more deeply lobed, and often 4′ long and 3′ wide. **Flowers** ⅝′–¾′ in diameter, on long slender pedicels, in compact few-flowered glabrous corymbs; calyx-tube narrowly obconic, glabrous, dark red, the lobes linear-lanceolate, entire or finely glandular-serrate; stamens usually 5, occasionally 6–10; anthers large, dark red-purple; styles 3, surrounded at base by a thin ring of hoary tomentum. **Fruit** ripening about the middle of September and soon falling, on stout pedicels, in drooping narrow clusters, short-oblong, full and rounded at the ends, dark crimson, lustrous, marked by minute pale dots, usually about ⅝′ long and ½′ in diameter; calyx enlarged and persistent, the lobes elongated, strongly incurved, often

Fig. 415

deciduous before the fruit ripens; flesh thick, dry and mealy; nutlets 3, narrowed and acute at the ends, prominently ridged on the back with a high broad ridge, ⅓′ long.

A tree, rarely more than 15° high, with a straight trunk 5′–6′ in diameter, covered with thin bark separating into papery lustrous pale scales, stout branches forming a broad open irregular head, and slender glabrous branchlets bright chestnut-brown during their first season, becoming ashy gray the following year, and armed with many thick straight or curved bright chestnut-brown or red-brown spines 1′–1½′ long.

Distribution. Low hills and limestone ridges; western and southern Vermont; southern Connecticut (rocky shore of Alewive Creek, Waterford, New London County), and eastern and central New York (Whitesboro, Oneida County).

64. Cratægus lucorum Sarg.

Leaves broad-ovate to obovate or rarely oval, broad-cuneate or rounded at the entire base, coarsely serrate above with straight teeth tipped with large persistent bright red glands, and deeply divided above the middle into 3 or 4 pairs of wide acute or acuminate lobes, rather more than a third grown when the flowers open early in May and then light yellow-bronze color, covered on the upper surface with short soft pale hairs and glabrous on the lower surface, and at maturity membranaceous, smooth, dark dull green and glabrous above, pale yellow-green below, about 2′ long and 1¼′ wide, with a slender yellow midrib, and 3 or 4 pairs of thin primary veins extending obliquely to the point of the lobes;

petioles slender, glandular, often somewhat winged toward the apex, 1′–1½′ in length; leaves at the end of vigorous shoots usually ovate and rounded at the broad base, more deeply lobed, and sometimes 3′ long and broad. **Flowers** ¾′ in diameter, on thin pedicels, in narrow compact few-flowered small villose corymbs; calyx broadly obconic, glabrous, the lobes narrow, acuminate. coarsely glandular-serrate, villose on the inner surface; stamens 20; anthers small, dark purple; styles 4 or 5. **Fruit** ripening about the middle of September and soon falling, on short stout pedicels, in erect few-fruited slightly villose clusters, obovoid until nearly fully grown and then short-oblong or somewhat obovoid, full and rounded at the ends, crimson, lustrous, marked by small pale dots, ½′–⅝′ long; calyx enlarged, the lobes elongated, coarsely glandular-serrate, villose above, closely appressed, often deciduous before the fruit ripens; flesh thick, yellow, dry and mealy; nutlets 4 or 5, thin, rounded, and sometimes obscurely ridged on the back, about ¼′ long.

A tree, 20°–25° high, with a tall straight trunk 6′–8′ in diameter, covered with close dark red-brown bark, slender ascending branches forming a narrow open head, and thin branch-

Fig. 416

lets dark green and somewhat villose when they first appear, becoming dull orange-brown in their first summer and ultimately dark gray-brown, and armed with straight or slightly curved bright red-brown lustrous spines 1′–1½′ long.

Distribution. Rich moist soil along the margins of Oak-groves on the banks of sloughs; Barrington, Cook County, Illinois; near Ithaca, Tompkins County, New York.

65. Cratægus lacera Sarg.

Leaves rhombic to broad-ovate or rarely obovate, acute at apex, broadly cuneate and entire at base, coarsely often doubly serrate above with straight glandular teeth, and divided above the middle into numerous acute lobes, when they unfold coated below with thick hoary tomentum and villose above, nearly fully grown when the flowers open about the 20th of April and then glabrous on the lower surface and covered on the upper surface with short scattered pale hairs, and at maturity glabrous, light yellow-green, paler below than above, thin, about 1½′ long and 1¼′ wide, with a slender yellow midrib and few remote primary veins; petioles slender, villose, becoming glabrous or puberulous, slightly winged at the apex, often red toward the base, ¼′–⅓′ in length; leaves at the end of vigorous shoots broad-ovate, often deeply 3-lobed, coarsely serrate, 3′–4′ long and broad. **Flowers** ¾′ in diameter, on slender villose pedicels, in sparingly villose few-flowered corymbs; calyx-tube narrowly obconic, glabrous, the lobes linear-lanceolate, elongated, coarsely glandular-serrate, glabrous on the outer surface, villose on the inner surface; stamens 20; anthers small, rose color; styles 4 or 5. **Fruit** ripening toward the end of October, on short stout gla-

brous pedicels, in erect few-fruited clusters, ellipsoidal, rounded at the ends, bright cherry-red, lustrous, marked by occasional large dark dots, about $\frac{1}{2}'$ long; calyx only slightly

Fig. 417

enlarged, with small nearly triangular villose spreading lobes mostly deciduous before the fruit ripens; flesh thick, orange color; nutlets 3–5, thin, narrowed at the ends, only slightly ridged on the rounded back, $\frac{5}{16}'$ long.

A slender tree, 25°–30° high, with a tall trunk 4′–5′ in diameter, covered with pale scaly bark, small short branches forming a narrow head, and slender branchlets dark olive-green and villose when they first appear, becoming light red-brown and glabrous during their first summer, and ultimately dull light gray, and armed with thin straight bright chestnut-brown lustrous spines $\frac{3}{4}'$–$1\frac{3}{4}'$ long.

Distribution. Low rich forest-glades near Fulton, Hempstead County, Arkansas.

66. Cratægus depilis Sarg.

Leaves ovate, acute or acuminate, rounded or broad-cuneate and often unsymmetrical at the entire base, sharply doubly serrate above with straight glandular teeth, and often

Fig. 418

divided into 4 or 5 pairs of short acute lobes, when they unfold deeply tinged with red and covered above with fine short caducous hairs, nearly half grown when the flowers open

during the second week of May, and at maturity membranaceous, glabrous, smooth, yellowish to bluish green on the upper surface, pale on the lower surface, $1\frac{1}{2}'$–$2'$ long, and $1'$–$1\frac{1}{4}'$ wide, with a slender midrib and 5 or 6 pairs of thin primary veins; turning yellowish and brown or russet color in the autumn; petioles slender, glabrous, sparingly glandular with minute glands, $\frac{3}{4}'$–$1'$ in length; leaves at the end of vigorous shoots often $2\frac{1}{2}'$ long and $1\frac{1}{2}'$ wide. **Flowers** $\frac{3}{4}'$ in diameter, on slender pedicels, in broad glabrous 8–12-flowered corymbs, with linear or oblong glandular bracts and bractlets; calyx narrowly obconic, glabrous, the lobes lanceolate, glandular-serrate, deeply tinged with purple; stamens 20; anthers pale rose color; styles 4 or 5. **Fruit** ripening early in September and soon falling, on slender pedicels, in drooping few-fruited clusters, subglobose to broad-obovoid, dark red to reddish purple, lustrous, $\frac{1}{2}'$–$\frac{3}{4}'$ long, and $\frac{3}{8}'$–$\frac{5}{8}'$ in diameter; calyx only slightly enlarged, the lobes reflexed, glandular-serrate, and red on the upper side toward the base; flesh thick, yellow, sweet, juicy and slightly acid; nutlets 4 or 5, full and rounded at apex, narrowed and acute at base, and prominently but irregularly ridged on the back with a high sometimes grooved ridge, $\frac{1}{4}'$–$\frac{5}{16}'$ long.

A tree, 20°–25° high, with a trunk 4′–8′ in diameter and 6°–9° long, covered with dark gray or gray-brown flaky bark, spreading branches forming an oblong or rounded open head, and slender glabrous branchlets bright red-brown and very lustrous during their first summer, becoming light gray-brown the following year, and armed with stout or slender nearly straight spines $\frac{3}{4}'$–$1\frac{1}{2}'$ long.

Distribution. Rich clay or gravelly soil in pastures and on the borders of woods; northeastern Illinois (Lake, Cook and Mill Counties).

67. Cratægus basilica Beadl.

Leaves ovate, acute or acuminate, broad-cuneate or rounded at the entire or crenate base, sharply and often doubly serrate above with straight slender glandular teeth, and

Fig. 419

divided into numerous short acute lateral lobes, more than half grown when the flowers open early in May and then roughened above by short pale hairs and glabrous below, and at maturity thin but firm in texture, bright green and scabrate above, paler below, $2\frac{1}{2}'$–$3'$ long, and $1\frac{1}{2}'$–$2'$ wide, with a slender yellow midrib, and thin veins arching to the point of the lobes; turning yellow and brown in the autumn; petioles slender, slightly winged at apex, $1'$–$1\frac{1}{2}'$ in length. **Flowers** $\frac{1}{2}'$–$\frac{5}{8}'$ in diameter, on elongated slender pedicels, in 5–15-flowered glabrous compact corymbs; calyx-tube broadly obconic, glabrous, the lobes slender, acuminate, glabrous, entire or occasionally serrate; stamens 15–20; anthers dark rose color;

styles 3–5. Fruit ripening and falling early in September, on slender pedicels, in few-fruited drooping clusters, subglobose, scarlet, covered with a glaucous bloom, $\frac{1}{2}'$–$\frac{5}{8}'$ in diameter; flesh soft, sweet, and edible; nutlets 3–5, narrowed and acute at the ends, prominently ridged on the back with a high broadly grooved ridge, $\frac{1}{4}'$–$\frac{5}{16}'$ long.

A tree, sometimes 20° high, with a trunk 7′–8′ in diameter, covered with dark gray or brown scaly bark, ascending or slightly spreading branches forming a narrow irregular head, and stout glabrous branchlets dark chestnut-brown in their first season becoming dark gray, and armed with numerous slender bright chestnut-brown lustrous ultimately gray spines 2′–2½′ long.

Distribution. Open woods and the borders of fields and roads, western North Carolina, usually at altitudes of 2000°–3000° above the sea.

VIII. MOLLES.

CONSPECTUS OF THE ARBORESCENT SPECIES.

Stamens 20.

Anthers pale yellow or white (*rose color in* 71).

Leaves broad and rounded, truncate or cordate at base; fruit subglobose to short-oblong or obovoid, red, crimson or scarlet.

Mature leaves glabrous on the upper surface.

Leaves thin.

Fruit subglobose to short-oblong, scarlet, ripening in August and September. 68. **C. mollis** (A).

Fruit obovoid to short-oblong, dark red, ripening in October. 69. **C. sera** (A).

Leaves subcoriaceous; fruit short-oblong to obovoid, crimson, ripening in October and November. 70. **C. arkansana** (C).

Mature leaves scabrate on the upper surface; fruit depressed-globose, red, ripening in August and September. 71. **C. gravida** (A).

Leaves broad-cuneate or rounded at base, acute or acuminate, scabrate on the upper surface at maturity.

Fruit red.

Leaves villose below at maturity on midrib and veins, those at the end of vigorous shoots cuneate at base; flowers in usually 7–12-flowered corymbs; fruit short-oblong, orange-red. 72. **C. invisa** (C).

Leaves hoary-tomentose below at maturity, those at the end of vigorous shoots rounded, cordate or abruptly cuneate at the broad base; flowers in 15–20-flowered corymbs; fruit ellipsoidal, ovoid, short-oblong or subglobose, crimson. 73. **C. limaria** (C).

Fruit bright canary yellow, subglobose; leaves villose below at maturity elliptic to ovate, oval or slightly obovate. 74. **C. viburnifolia** (C).

Leaves narrowed at base.

Mature leaves glabrous on the upper surface; fruit short-oblong to subglobose.

Leaves oblong-obovate or oval. 75. **C. Berlandieri** (C).

Leaves elliptic to ovate or slightly obovate. 76. **C. meridionalis** (C).

Mature leaves scabrate on the upper surface; fruit subglobose to short-oblong, red.

Leaves ovate to oval; flowers in 3–10-flowered corymbs; calyx-lobes glabrous. 77. **C. Treleasei** (C).

Leaves ovate; flowers in many-flowered corymbs; calyx-lobes villose. 78. **C. canadensis.**

Anthers rose color.

Leaves broad at base.

Mature leaves smooth on the upper surface.

Leaves thick, ovate, acute at apex; fruit short-oblong to obovoid, bright cherry red. 79. **C. corusca** (A).

Leaves thin, broad-ovate to suborbicular, rounded at apex; fruit subglobose to ovoid, bright yellow. 80. **C. Kelloggii** (A).

Mature leaves scabrate on the upper surface, oblong-obovate; fruit short-oblong, crimson. 81. **C. induta** (C).

Leaves narrowed at base; fruit red.

Leaves yellow-green.

Mature leaves glabrous on the upper surface; fruit short-oblong to obovoid. 82. **C. texana** (C).

Mature leaves scabrate on the upper surface.

Fruit subglobose to short-oblong. 83. **C. quercina** (C).

Fruit obovoid. 84. **C. dispersa** (C).

Leaves blue-green, subcoriaceous, ovate to suborbicular, scabrate on the upper surface; fruit subglobose to short-oblong, red. 85. **C. lanuginosa** (C).

Stamens 10.

Anthers yellow.

Leaves broad at base.

Leaves smooth on the upper surface.

Leaves ovate or rarely oval, dark yellow-green above; fruit subglobose, crimson, ripening late in August. 86. **C. arnoldiana** (A).

Leaves ovate, blue-green above; fruit obovoid to short-oblong, scarlet, ripening in September. 87. **C. champlainensis** (A).

Leaves scabrate on the upper surface, ovate, acute, rounded or abruptly cuneate at base; anthers nearly white; fruit short-oblong, bright orange-red. 88. **C. pennsylvanica** (A).

Leaves cuneate at base, scabrate on the upper surface, ovate, acute; fruit obovoid, orange-red. 89. **C. submollis** (A).

Anthers rose color.

Leaves broad at the rounded, abruptly cuneate or cordate base.

Leaves scabrate on the upper surface.

Leaves oval, rounded or cuneate at base; flowers in wide many-flowered corymbs; fruit short-oblong, crimson. 90. **C. Ellwangeriana** (A).

Leaves oblong-ovate; flowers in compact few-flowered corymbs; fruit obovoid to short-oblong, scarlet. 91. **C. Robesoniana** (A).

Leaves smooth on the upper surface at maturity, ovate, usually broad-cuneate at base; fruit obovoid to short-oblong, crimson. 92. **C. anomala** (A).

Leaves cuneate at base, smooth on the upper surface at maturity; fruit subglobose, orange-red. 93. **C. noelensis** (C).

68. Cratægus mollis Scheele. Red Haw.

Leaves broad-ovate, acute, usually cordate or rounded at the wide base, coarsely and generally doubly serrate with straight glandular teeth, and more or less deeply divided into 4 or 5 pairs of acute or rounded lateral lobes, covered above with short pale hairs and hoary-tomentose below when they unfold, about half grown when the flowers open early in May and then membranaceous, light yellow-green and hairy above and pubescent or tomentose below, and at maturity firm in texture, dark yellow-green and slightly rugose on the upper surface and paler and pubescent or puberulous on the lower surface along the stout midrib, and 4 or 5 pairs of primary veins extending to the point of the lobes, 3′–4′ long and broad; petioles stout, terete, at first tomentose, ultimately pubescent or nearly glabrous, often slightly glandular with small dark caducous glands, 1′–1½′ in length; leaves at the end of vigorous shoots more deeply lobed, with a deeper basal sinus, and frequently 5′–6′ long and broad. **Flowers** 1′ in diameter, on stout densely villose pedicels, in broad many-flowered tomentose corymbs, with conspicuous bracts and bractlets; calyx-tube narrowly obconic, hoary-tomentose, the lobes narrow, acuminate, coarsely glandular-serrate with bright red glands, villose on the outer, tomentose on the inner surface; stamens 20; anthers large, light yellow; styles 4 or 5, surrounded at base by a broad ring of hoary to-

mentum. **Fruit** ripening late in August and early in September, on stout pedicels, in drooping few-fruited villose clusters, short-oblong to subglobose, rounded at the ends, more or less pubescent, scarlet marked by occasional large dark dots; ¾′–1′ in diameter; calyx prominent, hairy, with large erect and incurved lobes usually deciduous before the fruit ripens; flesh thick, yellow, subacid, dry and mealy; nutlets 4 or 5, thin, rounded and obscurely ridged on the back, light brown, ¼′ long.

Fig. 420

A tree, sometimes 40° high, with a tall trunk often 18′ in diameter, heavy wide-spreading smooth ashy gray branches forming a broad round-topped and often symmetrical head, and stout branchlets covered at first with a thick coat of long white matted hairs, villose during their first season, becoming glabrous in their second year, and armed with occasional straight thick bright chestnut-brown shining spines 1′–2′ long.

Distribution. Low rich soil usually on the bottom-lands of streams; northern Ohio and southwestern Ontario (Point Edward) to northern Missouri, eastern South Dakota, eastern Nebraska, eastern Kansas, and Richland County, Illinois; common; near Nashville, Davidson County, Tennessee.

69. Cratægus sera Sarg.

Leaves oblong-ovate, acute or acuminate, rounded, truncate or slightly cordate at the broad base, irregularly divided into 4 or 5 pairs of short acute lateral lobes, and sharply and sometimes doubly serrate nearly to the base with straight glandular teeth, unfolding about the 1st of May with the opening of the flowers and then covered above with short soft white hairs and tomentose below, and at maturity membranaceous, dark yellow-green and glabrous on the upper surface, pubescent on the lower surface, 2′–4′ long, and 2½′–3′ wide, with a slender midrib, and thin remote primary veins extending to the point of the lobes; petioles slender, tomentose, becoming pubescent, 1′–1½′ in length; leaves at the end of vigorous shoots more deeply lobed, and often 4′–5′ long and 3′–4′ wide. **Flowers** ¾′ in diameter, on stout densely villose pedicels, in compact many-flowered tomentose corymbs; calyx-tube broadly obconic, coated with broad matted pale hairs, the lobes broad, acute or acuminate, glandular-serrate with large dark glands, tomentose on the outer surface and villose on the inner surface; stamens 20; anthers pale yellow; styles 4 or 5, usually 5. **Fruit** ripening about the 1st of October, on stout puberulous or villose pedicels, in drooping or erect few-fruited clusters, obovoid or short-oblong, dull dark red, marked by small pale dots, usually slightly villose or pubescent at the ends, ⅔′ long, and ½′ in diameter; calyx enlarged, with erect, coarsely glandular-serrate, incurved lobes often deciduous before the ripening of the fruit; flesh thick, dry and mealy; nutlets usually 5, thin, light brown, irregularly grooved on the back with a broad shallow groove, ¼′ long.

A tree, 30°–40° high, with a tall straight trunk 12′–18′ in diameter, thick branches forming a broad round-topped symmetrical head, and branchlets hoary-tomentose at first, be-

Fig. 421

coming light red-brown and puberulous and ultimately pale orange-brown, and armed with occasional straight or slightly curved chestnut-brown lustrous spines 1¼′–1½′ in length.

Distribution. Walpole Island, Lamberton County, southwestern Ontario; Belle Isle in the Detroit River, near Port Huron, St. Clair County, and in the neighborhood of Grand Rapids, Kent County, Michigan; northeastern Illinois (Cook, Will, Lake and Dupage Counties), and in the neighborhood of Milwaukee, Milwaukee County, Wisconsin.

70. Cratægus arkansana Sarg.

Leaves oblong-ovate or oval, acute, rounded, broadly cuneate or truncate at base, usually divided above the middle into 3 or 4 pairs of short broad acute lobes, and serrate sometimes to the base with short straight glandular teeth, when the flowers open about the

Fig. 422

middle of May nearly one third grown and coated with soft white hairs, and at maturity thick and leathery, dull dark green and glabrous on the upper surface, pale yellow-green on the lower surface, 2′–3′ long, and 1¾′–2′ wide, with a stout light yellow midrib and primary

veins slightly villose below, conspicuous secondary veins and reticulate veinlets; late in October and in November turning bright clear yellow; petioles stout, deeply grooved, more or less winged toward the apex, glandular with minute usually deciduous dark glands, at first tomentose, ultimately glabrous or puberulous, turning dark red after midsummer, 1′–1½′ in length; leaves at the end of vigorous shoots broad-ovate, rounded or truncate at base, often 4′ long and 3′ wide. **Flowers** nearly 1′ in diameter, on short stout pedicels, in broad rather compact many-flowered villose corymbs; calyx-tube narrowly obconic, coated with long matted pale hairs, the lobes short, acute, coarsely glandular-serrate, glabrous or slightly villose; stamens 20; anthers large, pale yellow; styles 5. **Fruit** ripening at the end of October and falling gradually at the end of several weeks, on stout villose pedicels, in few-fruited drooping clusters, short-oblong or rarely obovoid, rounded and slightly tomentose at the ends, bright crimson, very lustrous, marked by few large dark dots, ¾′–1′ long, about ¾ in diameter; calyx little enlarged, with small linear-lanceolate coarsely glandular-serrate erect and persistent lobes; flesh thick, yellow, subacid; nutlets 5, small in comparison to the size of the fruit, thin, rounded or slightly and irregularly ridged on the back, ⅓′ long.

A tree, 20° high, with a tall straight stem, thick slightly ascending wide-spreading branches forming a broad open irregular head, and stout branchlets dark green and covered early in the season with long pale hairs, becoming orange-brown, glabrous, and very lustrous in their first winter, and unarmed or armed with occasional straight light chestnut-brown shining spines, ½′–½′ in length.

Distribution. Bottom-lands of the White River near Newport, Jackson County, Arkansas; hardy as far north as eastern Massachusetts, and unsurpassed late in the autumn in the beauty of its large brilliant abundant fruits long persistent on the branches.

71. Cratægus gravida Beadl.

Leaves broad-ovate, acute, rounded or truncate at base, coarsely and often doubly serrate with incurved glandular teeth, and slightly incisely lobed, roughened above by short pale hairs and hoary-tomentose below when they unfold, nearly half grown when the

Fig. 423

flowers open about the 1st of May, and at maturity thin, firm, dark green, lustrous and scabrate above, paler and pubescent or puberulous below, particularly on the slender midrib and veins, 1¾′–2½′ long, and 1½′ wide; turning in the autumn yellow, orange and brown; petioles slender, tomentose early in the season, becoming pubescent or nearly glabrous, about ½′–1′ in length; leaves at the end of vigorous shoots oblong-ovate to nearly orbicular, round or cuneate at the broad base, more coarsely serrate, more deeply lobed,

and often $2\frac{1}{2}'$–$3'$ long and wide, their petioles $\frac{3}{4}'$–$1'$ long. **Flowers** about $\frac{5}{8}'$ in diameter, on short hoary-tomentose pedicels, in narrow crowded many-flowered hoary-tomentose corymbs; calyx-tube broadly obconic, covered with matted pale hairs, the lobes gradually narrowed, acuminate, glandular-serrate, villose; stamens 20; anthers dark rose; styles 5. **Fruit** ripening in August and September, on elongated tomentose pedicels, in few-fruited drooping clusters, depressed-globose, red; calyx enlarged, the lobes conspicuously serrate, puberulous on the upper surface, reflexed and closely appressed, sometimes deciduous from the ripe fruit; flesh thin, yellow, dry and mealy; nutlets 5, thin, narrow and rounded at base, acute at apex, rounded and obscurely grooved on the back, about $\frac{5}{16}'$ long.

A tree, sometimes 20° high, with a trunk 8′–10′ in diameter, heavy wide-spreading branches forming a broad round-topped head, and stout branchlets covered at first with a thick coat of matted pale hairs, orange-red and puberulous at the end of their first season, glabrous and reddish brown the following year, and armed with slender nearly straight spines about $1\frac{1}{2}'$ long.

Distribution. Limestone hills in the neighborhood of Nashville, Davidson County, Tennessee.

72. Cratægus invisa Sarg.

Leaves ovate to oval, acute or acuminate at apex, cuneate or rounded at base, coarsely often doubly serrate with broad straight glandular teeth, and slightly divided usually only above the middle into 3 or 4 pairs of small acuminate lobes, densely tomentose below and

Fig. 424

villose above when they unfold, about one third grown when the flowers open at the end of March and then thin, dark yellow-green and roughened on the upper surface by short hairs and coated below with long matted white hairs, and at maturity thin, yellow-green, scabrate and lustrous above, hairy below especially on the midrib and veins, $2\frac{1}{2}'$–$3'$ long, and $2'$–$2\frac{1}{2}'$ wide; petioles slender, slightly wing-margined at apex, covered with pale hairs early in the season, becoming nearly glabrous, and $1\frac{1}{2}'$–$2'$ in length; leaves at the end of vigorous shoots broad-ovate, acuminate, abruptly cuneate at the wide base, more coarsely serrate, deeply divided into acute lateral lobes, and often $3\frac{1}{2}'$–$4'$ long and $3'$–$3\frac{1}{2}'$ wide; petioles slender, villose, $1\frac{1}{2}'$–$2'$ in length. **Flowers** opening at the end of March, about $\frac{3}{4}'$ in diameter, on slender pedicels thickly coated like the wide calyx-tube with long matted white hairs, in broad mostly 7–12-flowered corymbs; calyx-lobes gradually narrowed from the base, short, broad, acuminate, laciniately glandular-serrate, thickly covered with long white hairs on the outer surface, villose above the middle on the inner surface; stamens 20; anthers white; styles 3–5, surrounded at base by a ring of long white hairs. **Fruit** ripening

at the end of October, on long slender slightly hairy pedicels, in erect or spreading few-fruited clusters, short-oblong, full and rounded and slightly hairy at the ends, orange-red, marked by large pale dots, and about $\frac{1}{2}'$ in diameter; calyx little enlarged, with spreading lobes dark red on the upper side below the middle and villose toward the apex; flesh thin, yellow, dry and mealy; nutlets 3–5, rounded at the ends, broader at apex than at base, rounded and only slightly grooved on the back, $\frac{1}{5}'$ long.

A tree, sometimes 30° high, with a tall trunk covered with dark brown bark broken into small closely appressed plate-like scales, large spreading branches forming a wide irregular head, and stout slightly zigzag branchlets clothed when they first appear with hoary tomentum, dull gray-brown, marked by small pale lenticels and slightly pubescent at the end of their first season and dark gray the following year, and unarmed or armed with occasional slender straight chestnut-brown spines $1'$–$1\frac{1}{4}'$ long.

Distribution. In dense woods on the rich bottom-lands of Red River near Fulton, Hempstead County, and near Texarkana, Miller County, Arkansas, Hugo, Choctaw County, Oklahoma, and to San Augustine, San Augustine County, Texas.

73. Cratægus limaria Sarg.

Cratægus Mackensenii Sarg.

Leaves ovate, acute, concave-cuneate or rounded at base, coarsely often doubly serrate with broad straight glandular teeth, and slightly divided into 3 or 4 pairs of small acute lateral lobes, not more than a quarter grown when the flowers open early in April and then

Fig. 425

thin, yellow-green and covered above with short white hairs and thickly coated below with hoary tomentum, and at maturity light green and scabrate on the upper surface, pale and tomentose on the lower surface, $2\frac{1}{2}'$–$3'$ long, and $1\frac{1}{2}'$–$2'$ wide, with a stout midrib and thin primary veins; petioles slender, slightly wing-margined at apex, covered when they first appear with long matted white hairs, villose through the season, and $1'$–$1\frac{1}{2}'$ in length; leaves at the end of vigorous shoots broad-ovate, rounded or cordate at the wide base, more deeply lobed, and often $4'$ long and broad. **Flowers** opening early in April, $\frac{4}{5}'$–$1'$ in diameter, on long slender pedicels coated with matted white hairs, in compact 15–20-flowered villose corymbs; calyx-tube broadly obconic, thickly covered with white hairs, the lobes gradually narrowed from the base, wide, acuminate, laciniately glandular-serrate, villose; stamens 20; anthers white; styles 3–5, surrounded at base by a narrow ring of pale tomentum. **Fruit** ripening in October, on long stout erect or spreading hairy pedicels, in few-fruited clusters, ellipsoidal to ovoid or short-oblong, rounded at apex, truncate at base,

crimson, lustrous, marked by large pale dots, villose especially at the ends, $\frac{1}{2}'$–$\frac{3}{5}'$ in diameter; calyx prominent, with a long villose tube, and erect villose persistent lobes dark red on the upper side below the middle, their tips slightly spreading or incurved; flesh thick, yellow, dry and mealy; nutlets 3–5, narrowed and rounded at apex, rounded at the broad base, slightly grooved on the back, $\frac{1}{5}'$–$\frac{1}{4}'$ long.

A tree, often 30° high, with a tall trunk 8′–12′ in diameter, covered with dark scaly bark, stout ascending branches forming a narrow irregular head, and slender zigzag branchlets thickly coated when they first appear with long white hairs, light orange-brown, lustrous, pubescent and marked by pale lenticels at the end of their first season, dull gray-brown and glabrous the following year, and armed with slender straight or slightly curved purple ultimately ashy gray spines 2′–$2\frac{1}{2}'$ long.

Distribution. In dense woods on the rich bottom-lands of the Red River near Fulton, Hempstead County, Arkansas; river banks; western Texas (Guadalupe River, near Victoria, Victoria County; Cibolo River, Sutherland Springs, Wilson County; San Antonio River, Bexar County; *C. Mackensenii* Sarg.).

74. Cratægus viburnifolia Sarg.

Leaves elliptic to ovate, oval or slightly obovate, acute or rounded at apex, concave-cuneate at the entire base, coarsely often doubly serrate above with straight glandular teeth, and slightly and irregularly divided above the middle into 2 or 3 pairs of small acute

Fig. 426

lobes, half grown when the flowers open about the 20th of March and then thin, yellow-green and roughened above by short white hairs and hoary-tomentose below, and at maturity thick, deep green, very lustrous and scabrate on the upper surface, coated on the lower surface with pale hairs, $2\frac{1}{2}'$–$3\frac{1}{2}'$ long, and 2′–$2\frac{1}{2}'$ wide, with a prominent midrib and primary veins; petioles slightly wing-margined at apex, densely hoary-tomentose early in the season, becoming glabrous, $\frac{3}{5}'$–$1\frac{1}{2}'$ in length. **Flowers** about $\frac{3}{4}'$ in diameter, on long slender tomentose pedicels, in wide lax mostly 5–12-flowered corymbs, with large lanceolate to spatulate foliaceous bracts and bractlets slightly serrate above the middle, and generally persistent until after the petals fall; calyx-tube narrowly obconic, thickly coated with matted white hairs, the lobes gradually narrowed from the base, long, slender, acuminate, laciniately glandular-serrate, slightly villose on the outer surface, densely villose on the inner surface; stamens 20; anthers white; styles 4 or 5. **Fruit** ripening early in October, on long slender drooping slightly hairy pedicels, in few-fruited clusters, subglobose, bright canary yellow, about 1′ in diameter; calyx little enlarged, with spreading lobes; flesh thick, light yellow, soft and succulent; nutlets 4 or 5, gradually narrowed and rounded at the ends, irregularly ridged on the back with a broad grooved ridge, $\frac{1}{3}'$ long.

A tree, 30°–35° high, with a tall trunk sometimes a foot in diameter, covered with gray scaly bark, large ascending and spreading branches forming an open irregular head, and stout nearly straight unarmed branchlets thickly coated with hoary tomentum when they first appear, becoming purple, lustrous and nearly glabrous at the end of their first season and dark brown or gray-brown the following year.

Distribution. Borders of woods in low ground, valley of the Brazos River near Columbia, Brazoria County, and in low woods on the Colorado River, at Wharton, Wharton County, Texas.

75. Cratægus Berlandieri Sarg.

Leaves oblong-obovate or oval, acute or acuminate, gradually narrowed, cuneate and entire below the middle, coarsely and often doubly serrate with broad straight or incurved glandular teeth, and unequally divided above into numerous acute or acuminate lobes,

Fig. 427

when the flowers open from the middle to the end of March coated on the upper surface with short pale caducous hairs and on the lower surface with thick hoary tomentum, and at maturity thin and firm in texture, glabrous, dark green, and lustrous above, pale and pubescent below, and usually about 3′ long and 2′ wide, with a slender midrib, remote primary veins extending to the point of the lobes, conspicuous secondary veins, and reticulate veinlets; petioles more or less winged toward the apex, tomentose early in the season, becoming pubescent, ½′–¾′ in length; leaves at the end of vigorous shoots often 5′ long and 3′ wide, with rounded, acute lobes. **Flowers** ¾′ in diameter, on long stout hoary-tomentose pedicels, in broad loose many-flowered tomentose corymbs, with oblong-obovate to lanceolate finely glandular-serrate villose conspicuous bracts and bractlets; calyx-tube broadly obconic, covered with thick pale tomentum, the lobes broad, acute, very coarsely glandular-serrate, tomentose on the outer surface and villose on the inner surface; stamens 20, anthers yellow; styles 5, surrounded at base by tufts of white hairs. **Fruit** ripening after the middle of October, on slender elongated pedicels, in loose drooping clusters, short-oblong to subglobose, scarlet, about ½′ long; calyx much enlarged, with coarsely serrate erect and persistent villose lobes; flesh thin, yellow, dry and mealy; nutlets 5, rounded and occasionally obscurely grooved on the back, about ¼′ long.

A tree, 15°–20° high, with a tall straight trunk 8′–10′ in diameter, covered with thin dark brown furrowed bark, spreading branches forming a broad open head, and branchlets hoary-tomentose at first, soon puberulous, dull reddish brown or yellow-brown by midsummer, becoming ashy gray late in the autumn, and armed with few straight gray spines about 1′ in length.

Distribution. Low rich woods on the bottom-lands of the Brazos River at Columbia and Brazoria, Brazoria County, Texas.

76. Cratægus meridionalis Sarg.

Leaves elliptic to ovate or slightly obovate, acuminate, cuneate at the entire base, and coarsely often doubly serrate above with broad straight glandular teeth, coated below with hoary tomentum and covered above with short white hairs when they unfold, more than half grown when the flowers open from the first to the middle of April, and at maturity thin, yellow-green and scabrate on the upper surface, paler and villose-pubescent on the lower surface, especially on the slender midrib and primary veins, 2′–3½′ long, and 1′–2′ wide; petioles slender, slightly wing-margined at apex, densely villose-pubescent with white hairs early in the season, becoming glabrous or nearly glabrous, ½′–¾′ in length; leaves at the end of vigorous shoots broad-ovate to broad-elliptic, more coarsely serrate, occasionally

Fig. 428

slightly divided into short broad lateral lobes, often 4′ long and 2½′ wide, with a stout midrib and petioles broadly wing-margined at apex, and about ½′ in length. **Flowers** ¾′ in diameter, on stout pedicels thickly covered like the narrow obconic calyx-tube with matted silvery white hairs, in broad compact many-flowered villose corymbs, with conspicuous glandular-serrate villose bracts and bractlets mostly persistent until after the flowers open; calyx-lobes narrow, acuminate, laciniately glandular-serrate, slightly villose-pubescent when the buds open; stamens 20; anthers white; styles 3–5, surrounded at base by a broad ring of white tomentum. **Fruit** ripening from the middle to the end of September, on elongated slender puberulous pedicels, in few-fruited drooping red-stemmed clusters, short-oblong to subglobose, rounded at the ends, scarlet, ½′ to ⅔′ in diameter, the calyx persistent, much enlarged, with erect or spreading conspicuous lobes; nutlets 3–5, rounded at base, acute at apex, ridged on the back with a high rounded ridge, about ½′ long.

A tree, often 25° high, with a trunk 8′ in diameter, covered with dark bark slightly divided by shallow fissures into broad thin plates, spreading ashy gray branches forming a round-topped head, and slender zigzag branchlets, covered when they first appear with long white hairs, soon glabrous, orange-brown or reddish brown during their first season and dull gray the following year, and armed with numerous straight slender purple spines 1′–2′ in length.

Distribution. Limestone soil, in upland woods and glades; common in the limestone belt of central Alabama, from the neighborhood of Gallion, Hale County to western Mississippi (Starkville, Oktibbeha County, and Brookville, Noxubee County).

77. Cratægus Treleasei Sarg.

Leaves ovate to elliptic, acute, concave-cuneate or rounded at the narrow base, sharply doubly serrate above with straight glandular teeth, and slightly divided into 3 or 4 pairs of

narrow acuminate lateral lobes, unfolding with the opening of the flowers at the end of April or early in May and then light yellow-green tinged with bronze color, lustrous and covered above with short shining caducous white hairs and hoary-tomentose below, and at maturity thin, light yellow-green and scabrate on the upper surface, paler and pubescent on the lower surface, especially on the slender midrib, and 4 or 5 pairs of thin primary veins extending obliquely to the point of the lobes, $1\frac{3}{4}'$–$2\frac{1}{4}'$ long, and $1\frac{1}{2}'$–$2'$ wide; petioles slender, more or less wing-margined at apex, villose early in the season, pubescent in the autumn, $\frac{1}{2}'$–$\frac{3}{4}'$ in length: leaves at the end of vigorous shoots broad-ovate, acute, cuneate at the wide base, often $2\frac{1}{2}'$–$3'$ long and $2'$–$2\frac{1}{2}'$ wide; petioles stout, wing-margined at apex $\frac{3}{4}'$–$1'$ long. **Flowers** $1'$ in diameter, on short stout pedicels covered with matted pale hairs, in 3–10-flowered compact compound or rarely simple villose corymbs; calyx-tube broadly obconic, covered with matted pale hairs, the lobes glabrous, narrowed from the base, with wide rounded sinuses between them, slender, acuminate, tipped with a small red

Fig. 429

gland, and glandular-serrate with stipitate red glands; stamens 20; anthers pale yellow; styles 4 or 5, usually 5. **Fruit** ripening at the end of September, on stout erect villose pedicels, in few-fruited clusters, subglobose, often broader than high, crimson, lustrous, marked by numerous large pale dots, pubescent at the ends, and $\frac{1}{2}'$–$\frac{3}{4}'$ in diameter; calyx prominent, with a short villose tube, and reflexed appressed villose lobes often deciduous from the ripe fruit; flesh thick, light yellow, dry and mealy; nutlets 4 or 5, thin, full and rounded at apex, narrowed and acute at base, grooved with a broad shallow groove and sometimes irregularly ridged on the back, about $\frac{5}{16}'$ long.

A tree, 20°–25° high, with a tall trunk sometimes $6'$ in diameter, slender branches forming a narrow open head, and thin nearly straight branchlets thickly covered at first with long lustrous white hairs, dull light reddish brown and puberulous at the end of their first season, becoming dark gray-brown, and armed with stout straight or slightly curved dark purple shining spines usually about $1\frac{1}{2}'$ long, or unarmed.

Distribution. Banks of small streams in moist soil from Doe Run to Bismarck, St. François County, Missouri.

78. Cratægus canadensis Sarg.

Leaves ovate, short-pointed, slightly lobed usually only above the middle with short broad acute lobes, and coarsely and frequently doubly serrate to the broad-cuneate base with spreading glandular teeth, coated above in early spring with soft white hairs, and below with dense hoary tomentum, about a third grown when the flowers open at the end of May, and at maturity thin and firm in texture, blue-green and scabrate on the

upper surface, pale and pubescent on the lower surface on the midrib and primary veins, 2′–2½′ long, and 1½′ to nearly 3′ wide; petioles slender, glandular, often more or less winged above, at first tomentose, becoming nearly glabrous, ¾′–1′ in length; leaves at the end of vigorous shoots broad-ovate, truncate or slightly cordate at the broad base, more deeply lobed, often 2½′–3′ long and wide, the petioles wing-margined at apex often glandular, and 1′–1½′ in length. **Flowers** about ¾′ in diameter, in broad loose tomentose corymbs; calyx-tube broadly obconic, villose with long matted hairs, the lobes lanceolate, villose, and glandular with large red stipitate glands; stamens 20; anthers small, nearly white; styles 5, surrounded at base by a thin ring of pale tomentum. **Fruit** ripening early in October and falling gradually until after midwinter, on stout pedicels, in erect slightly villose few-fruited clusters, short-oblong to subglobose, crimson, lustrous, marked by large scattered pale dots, slightly hairy toward the ends, ½′–⅝′ long, ⅓′–½′ in diameter; calyx prominent, the lobes gradually narrowed from a broad base, elongated, glandular, villose,

Fig. 430

spreading or reflexed, often deciduous before the fruit ripens; flesh thin, pale yellow, dry and mealy; nutlets 5, thin, rounded and irregularly ridged on the back, ¼′ long.

A tree, 18°–30° high, with a trunk 6′–8′ in diameter, stout spreading branches forming a broad round-topped symmetrical head, and stout zigzag branchlets dark green and covered with matted pale hairs when they first appear, soon becoming light orange-brown and very lustrous, and armed with numerous stout straight or slightly curved dark chestnut-brown shining spines 2′–2½′ long.

Distribution. Limestone ridges near the St. Lawrence River at Châteaugay, Caughnawaga, and La Tortue in the Province of Quebec.

79. Cratægus corusca Sarg.

Leaves ovate, acute, truncate, rounded or slightly cordate at the broad base, regularly divided into 4 or 5 pairs of short acute lateral lobes, and doubly serrate with straight glandular teeth, when they unfold covered above with short soft pale hairs and glabrous below, about a third grown when the flowers open the middle of May, and at maturity thin but firm and rigid in texture, glabrous, dark yellow-green, bright and lustrous above, pale yellow-green below, 2′–2½′ long and wide, with a slender pale midrib and primary veins; petioles slender, villose early in the season, soon becoming glabrous and dark red below the middle, 1½′–2½′ in length; leaves at the end of vigorous shoots frequently divided into narrow acute lateral lobes, and often 3½′–4′ long and wide. **Flowers** ¾′ in diameter, on stout villose pedicels, in compact narrow many-flowered corymbs covered with matted pale hairs; calyx-tube narrowly obconic, glabrous, or villose toward the base, the

lobes narrowed from a broad base, acute, coarsely glandular-serrate, villose on the inner surface; stamens 20; anthers small, pale pink; styles 4 or 5. **Fruit** beginning to ripen and fall about the middle of September and continuing to fall until the end of October, on stout pedicels, in glabrous few-fruited clusters, short-oblong to obovoid, bright cherry-red, lustrous, marked by dark scattered pale dots, $\frac{5}{8}'$–$\frac{3}{4}'$ long, and $\frac{1}{2}'$–$\frac{5}{8}'$ in diameter: calyx little

Fig. 431

enlarged, the lobes slightly glandular-serrate, usually deciduous before the fruit ripens; flesh thick, yellow, dry and mealy; nutlets 4 or 5, dark-colored, rounded on the back, $\frac{1}{4}'$ long.

A tree, 18°–20° high, with a tall trunk 8′–10′ in diameter, wide-spreading branches forming a handsome symmetrical head, and stout branchlets dark green and coated with matted pale hairs when they first appear, soon becoming light red-brown, light orange-brown and lustrous in their second year, and armed with thick nearly straight bright chestnut-brown spines often 3′ in length.

Distribution. Sandy shores of Lake Zurich, Lake County, Illinois.

80. Cratægus Kelloggii Sarg.

Leaves broad-ovate to suborbicular, rounded and often short-pointed at apex, rounded, broadly cuneate or truncate at the entire base, coarsely serrate above with straight gland-tipped teeth, and divided usually only above the middle into several short broad acute or acuminate lobes, about half grown when the flowers open during the last week of April and then thin, yellow-green, covered above with short pale hairs and pubescent below on the midrib and veins, and at maturity thin but firm in texture, dark yellow-green, glabrous and smooth on the upper surface, pale and glabrous on the lower surface with the exception of a few hairs near the base of the thin yellow midrib and of the 4 or 5 pairs of slender prominent primary veins arching to the point of the lobes, 2′–$2\frac{1}{2}'$ long, $1\frac{3}{4}'$–$2\frac{1}{2}'$ wide, and often broader than long; petioles slender, slightly winged at apex, villose while young with long matted white hairs, becoming glabrous, $\frac{3}{4}'$–1′ in length. **Flowers** $\frac{5}{8}'$ in diameter, on slender hairy pedicels, in compact 5–10-flowered villose corymbs, with oblong-obovate to linear acuminate glandular bracts and bractlets mostly persistent until the flowers open; calyx-tube broadly obconic, slightly hairy at base, glabrous above, the lobes slender, acuminate, glandular with minute dark red stipitate glands, or entire, glabrous on the outer surface, sparingly villose on the inner surface; stamens 20; anthers pale rose color; styles 5. **Fruit** ripening at the end of September and soon falling, on long slender glabrous pedicels, in few-fruited drooping clusters, subglobose to short-ovoid, bright yellow, marked by many small

pale dots, $\frac{3}{4}'$–1′ in diameter; calyx small, with spreading reflexed lobes slightly villose toward the apex and often deciduous from the ripe fruit; flesh thin, yellow, dry and mealy; nutlets 5, rounded and very slightly grooved on the back, about $\frac{3}{8}'$ long.

A tree, 20°–25° high, with a tall trunk 4′–5′ in diameter, covered with nearly black deeply furrowed bark, erect branches, and nearly straight branchlets dark green tinged

Fig. 432

with red and slightly villose when they first appear, bright red-brown and lustrous at the end of their first season, becoming dark dull reddish brown the following year, and unarmed, or armed with slender nearly straight bright chestnut-brown shining spines usually about 1′ long.

Distribution. Banks of the Desperes River, South St. Louis, St. Louis County, Missouri; not common.

81. Cratægus induta Sarg. Turkey Apple.

Leaves oblong-obovate, acute, cuneate, rounded or rarely truncate at the broad entire base, coarsely doubly serrate above with glandular teeth, and slightly and irregularly divided into broad acute lateral lobes, about a third grown when the flowers open from

Fig. 433

the middle to the end of April and then thin, light yellow-green and roughened above by short lustrous white hairs and hoary-tomentose below, and at maturity thin, dark yellow-green and scabrate on the upper surface, pale and tomentose or pubescent on the lower surface, particularly on the stout midrib and 4 or 5 pairs of prominent primary veins, 3′–4′ long, and 2½′–3′ wide; petioles slender, more or less wing-margined at the apex, glandular, hoary-tomentose early in the season, becoming sparingly villose in the autumn, 1¼′–1½′ in length. **Flowers** ¾′ in diameter, on slender tomentose pedicels, in broad many-flowered hoary-tomentose corymbs; calyx-tube narrowly obconic, thickly coated with long densely matted white hairs, the lobes small, acuminate, glandular-serrate, villose; stamens 20; anthers small, rose color; styles 5, surrounded at base by a broad ring of snow-white hairs. **Fruit** ripening the middle of October, on stout villose pedicels, in few-fruited clusters, short-oblong, rounded and villose at the ends, crimson or reddish yellow, lustrous, marked by small pale dots, ¾′–2′ in diameter; calyx prominent, with a short tomentose tube and much enlarged coarsely glandular-serrate hairy erect incurved lobes often deciduous from the ripe fruit; flesh thick, orange-colored, with an astringent subacid flavor; nutlets 5, thin, rounded and slightly grooved on the back, 5/16′–⅜′ long.

A tree, sometimes 25° high, with a trunk often a foot in diameter, covered with thick dark brown furrowed bark, large spreading and ascending branches forming an open irregular head, and stout branchlets covered at first with long matted white hairs, light orange-brown, lustrous and puberulous at the end of their first season, becoming ashy gray or light grayish brown the following year, and armed with many stout nearly straight dark purple shining spines usually about 2½′ long.

Distribution. Dry upland woods, near Fulton, Hempstead County to Texarkana, Miller County, and Prescott, Nevada County, Arkansas; common.

82. Cratægus texana Buckl.

Leaves broad-ovate, acute or rarely rounded at apex, broadly concave-cuneate at base, coarsely doubly glandular-serrate above, and usually divided above the middle into 4 or 5 pairs of broad acute lobes, covered above when they unfold with short soft pale hairs and

Fig. 434

below with a thick coat of hoary tomentum, more than half grown when the flowers open late in March, and at maturity thick and firm, dark green and lustrous above, pale and pubescent or tomentose below, particularly on the stout midrib, primary veins, prominent secondary veins and reticulate veinlets, 3′–4′ long, 2½′–3′ wide; petioles stout, deeply grooved, more or less winged above, at first tomentose, becoming nearly glabrous, ½′–¾′ in length; leaves at the end of vigorous shoots sometimes truncate or slightly cordate at the broad base, more deeply lobed, and frequently 3′ long and wide. **Flowers** ¾′ in diameter, on

elongated slender densely villose pedicels, in broad open many-flowered tomentose corymbs, with oblong or oblong-obovate acute conspicuous villose bracts and bractlets often $1\frac{1}{2}'$ in length; calyx-tube broadly obconic, coated with pale tomentum, the lobes foliaceous, gradually narrowed from a broad base, acuminate, coarsely glandular-serrate, and villose with long matted pale hairs; stamens 20; anthers large, dark red; styles 5, surrounded at base by a narrow ring of pale tomentum. **Fruit** ripening toward the end of October, in drooping many-fruited tomentose ultimately glabrous clusters, obovoid and tomentose until nearly grown, becoming when fully ripe short-oblong or slightly obovoid, rounded at the ends, bright scarlet, marked by occasional large pale dots, puberulous at apex, $\frac{3}{4}'$–$1'$ long; calyx enlarged, with glandular-serrate usually erect lobes, dark red at base on the upper side, often deciduous before the ripening of the fruit; flesh thick, yellow, sweet, and edible; nutlets 5, slightly grooved on the back, $\frac{1}{4}'$–$\frac{1}{3}'$ long.

A tree, often 30° high, with a tall trunk sometimes a foot in diameter, thick branches ascending while the tree is young, forming an open irregular crown, and spreading in old age into a broad symmetrical round-topped head, and branchlets dark bronze-green and covered with long matted white hairs when they first appear, becoming dull reddish brown and ultimately pale ashy gray, and armed with occasional thin nearly straight bright chestnut-brown lustrous spines usually about 2′ long, or often unarmed.

Distribution. Rich bottom-lands, Texas coast region; valley of the lower Brazos River to those of the Navidad (Canardo, Jackson County), Guadalupe (Victoria, Victoria County), and Cibolo (Sutherland Springs, Wilson County).

83. Cratægus quercina Ashe.

Leaves elliptic to obovate, usually acute or occasionally rounded at apex, obtusely or acutely cuneate at the entire base, irregularly doubly serrate above with slender glandular teeth, and often divided above the midrib into narrow acuminate lobes, when they unfold

Fig. 435

conspicuously plicate, often dark red and coated above with long soft pale hairs and covered below with a thick coat of silvery white shining tomentum, about a third grown when the flowers open from the middle to the end of March, and at maturity thin but firm in texture, dark green, lustrous and scabrate above, pale and pubescent or tomentose below, and $2'$–$2\frac{1}{2}'$ long and wide, with a slender midrib, 4 or 5 pairs of thin primary veins, and conspicuous reticulate veinlets; petioles stout, tomentose, about $\frac{1}{2}'$ in length; leaves at the end of vigorous shoots broad-ovate, rounded or obtusely cuneate at the wide base, usually deeply divided into numerous acuminate lateral lobes, often 3′ long and $2\frac{1}{2}'$ wide. **Flowers** $\frac{3}{4}'$ in diameter, on long slender tomentose pedicels, in broad many-flowered lax hoary-tomen-

tose corymbs, with oblong-obovate glandular-serrate villose bracts and bractlets; calyx-tube narrowly obconic, hoary-tomentose, the lobes short, acute, coarsely glandular-serrate, tomentose; stamens 20; anthers small, dark red; styles 5, surrounded at base by tufts of long snow-white hairs. **Fruit** ripening after the middle of October, on slender nearly glabrous pedicels, in few-fruited tomentose spreading clusters, subglobose but often rather longer than broad, rounded at the ends, tomentose until nearly fully grown, glabrous at maturity, dark red, marked by numerous large pale dots, about $\frac{1}{2}'$ in diameter; calyx prominent, with short spreading often deciduous lobes; flesh thin, light yellow, hard and dry, generally shrivelling before the fruit falls; nutlets 5, rounded and ridged on the back, about $\frac{1}{4}'$ long.

A tree, remarkable for the lustre of its white tomentum, occasionally 25° high, with a tall trunk 6′–8′ in diameter, covered with light gray scaly bark, becoming near the base of old trees deeply furrowed and nearly black, ascending branches forming a broad symmetrical head, and branchlets coated when they first appear with hoary tomentum, becoming light red-brown and more or less villose during their first season, glabrous and rather darker in their second year, and armed with numerous straight or slightly curved chestnut-brown shining spines usually $1'–1\frac{1}{4}'$ long.

Distribution. Sandy bottom-lands in open Live Oak-forests on the Brazos River, near Columbia, Brazoria County, Rosenburg and Richmond, Fort Bend County, Wharton, Wharton County, and San Augustine, San Augustine County, Texas.

84. Cratægus dispersa Ashe.

Cratægus pyriformis Britt.

Leaves oval to broad-ovate, acute and often short-pointed at apex, gradually narrowed and concave-cuneate at the entire base, sharply and sometimes doubly serrate above with straight glandular teeth, and often slightly and irregularly lobed above the middle, fully

Fig. 436

grown when the flowers open about the 10th of May and then thin, light yellow-green, roughened above by short rigid pale hairs and pubescent below, particularly on the slender midrib and 5 or 6 pairs of remote primary veins, and at maturity thin and firm, lustrous and scabrate on the upper surface, pale and pubescent on the lower surface, and generally about 3′ long and 2′ wide; petioles slender, winged at apex, tomentose, ultimately pubescent, $1'–1\frac{1}{4}'$ in length; leaves at the end of vigorous shoots usually ovate, coarsely serrate, more deeply lobed, and frequently 4′–5′ long and 3′–4′ wide. **Flowers** 1′ in diameter, on long slender tomentose pedicels, in broad many-flowered lax corymbs; calyx-tube narrowly obconic, villose, the lobes narrow, acuminate, glandular-serrate, and covered more or less thickly with pale hairs; stamens 20; anthers pale rose color; styles 4 or 5, usu-

ally 5, surrounded at base by a broad ring of pale tomentum. **Fruit** ripening in October, on long slender pubescent pedicels, in drooping few-fruited clusters, obovoid, rounded at the ends, bright cherry-red, lustrous, marked by occasional large pale dots, about $\frac{5}{8}'$ long and $\frac{1}{2}'$ in diameter; calyx prominent, with linear glandular-serrate closely appressed lobes often deciduous before the fruit ripens; flesh thin, light yellow, juicy; nutlets 4 or usually 5, rounded, and deeply grooved on the back, dark brown, $\frac{5}{8}'$ long.

A tree, 25°–30° high, with a trunk a foot in diameter, spreading branches forming a broad symmetrical head, and slender branchlets light green and villose when they first appear with long matted pale hairs, dull red-brown and pubescent in their first season, becoming glabrous the following year, and armed with occasional thin nearly straight bright chestnut-brown shining spines usually about $1\frac{1}{2}'$ long.

Distribution. Rich bottom-lands of the streams of Shannon County, southern Missouri.

85. Cratægus lanuginosa Sarg.

Leaves ovate to suborbicular, acute or rounded and short-pointed at apex, broadly cuneate or rounded at the entire base, coarsely and sharply doubly serrate above with glandular teeth, and often irregularly divided above the middle into short broad acute

Fig. 437

lateral lobes, less than half grown when the flowers open during the last week of April and then dark green and villose above and covered below with a thick coat of hoary tomentum, and at maturity subcoriaceous, dark blue-green, lustrous and scabrate on the upper surface, yellow-green and tomentose on the lower surface, $1\frac{1}{2}'$–$2'$ long, and $1'$–$1\frac{1}{2}'$ wide, with a thick midrib, and 3–5 pairs of stout primary veins extending obliquely to the point of the lobes; petioles stout, tomentose, $\frac{1}{2}'$–$\frac{3}{4}'$ in length; leaves at the end of vigorous shoots often broad-ovate, very coarsely glandular-serrate, rounded or truncate at base, and frequently $3'$ long and wide. **Flowers** $\frac{3}{4}'$ in diameter, on short stout pedicels covered with long matted pale hairs, in compact many-flowered hoary-tomentose corymbs, with large glandular-serrate conspicuous bracts and bractlets persistent until the flowers open; calyx-tube broadly obconic, hairy, the lobes short, broad, acute, glandular with minute stipitate glands, densely villose on the outer surface and slightly villose on the inner surface; stamens 20; anthers rose color; styles 5, surrounded at base by large tufts of snow-white hairs. **Fruit** ripening at the end of October, on short tomentose erect pedicels, in few-fruited clusters, subglobose to short-oblong, rounded and slightly hairy at the ends, $\frac{1}{2}'$ in diameter; calyx enlarged, with villose coarsely serrate usually erect spreading or incurved persistent lobes bright red on the upper side near the base; flesh thin, orange color, dry and mealy; nutlets 5, thin, rounded and very irregularly ridged on the back, about $\frac{1}{4}'$ long.

A tree, sometimes 25° high, with a stout trunk covered with pale bark, spreading and

erect branches, and stout zigzag branchlets light green and villose early in the season, dull red-brown and sparingly villose or pubescent at the end of their first year, becoming dark or light gray-brown, and armed with many long straight purple shining ultimately ashy gray spines $1\frac{1}{4}'$–$3\frac{1}{2}'$ in length.

Distribution. Southwestern Missouri; common near Webb City, Jasper County, to Gum Springs, Clark County, Arkansas; well distinguished by the distinctly blue color of the small leaves, the dark crimson hard fruits and by the remarkable development of the spines unusual in the species of this group.

86. Cratægus arnoldiana Sarg.

Leaves broad-ovate or rarely oval, acute, regularly divided above the middle into numerous short acute lobes, and coarsely doubly serrate with straight glandular teeth except at the rounded truncate or occasionally cuneate base, coated with dense matted pale hairs when they unfold, about half grown when the flowers open at the end of May or early in June and then roughened above by stout stiff hairs and soft-pubescent below, and at maturity thin, smooth, very dark green and lustrous above, paler below, and slightly villose on the under side of the slender midrib, and of the thin prominent primary veins extending

Fig. 438

to the point of the lobes, 2′–3′ long and wide; petioles slender, densely villose early in the season, becoming puberulous, $\frac{3}{4}'$–$1\frac{1}{2}'$ in length; leaves at the end of vigorous shoots acute or acuminate, round or obtusely cuneate at base, more deeply lobed, often 3′–4′ long and 3′ wide. **Flowers** about $\frac{3}{4}'$ in diameter, on slender pedicels, in broad many-flowered tomentose corymbs; calyx-tube broadly obconic, densely tomentose, the lobes narrow, elongated, acuminate, glandular-serrate, villose on both surfaces; stamens 10; anthers, large, pale yellow; styles 3–5, usually 3 or 4, surrounded at base by a broad ring of thick hoary tomentum. **Fruit** ripening about the middle of August and mostly falling before the first of September, on stout pedicels, in erect spreading or rarely drooping few-fruited villose clusters, subglobose but rather longer than broad, bright crimson marked by many large pale dots, villose, particularly toward the ends, with long scattered white hairs, $\frac{3}{4}'$ long; calyx little enlarged, with elongated coarsely glandular-serrate spreading lobes often deciduous before the fruit ripens; flesh thick, bright yellow, subacid; nutlets 3 or 4, light-colored, prominently ridged on the back with a high rounded ridge, about $\frac{1}{4}'$ long.

A tree, 15°–20° high, with a short trunk 10′–12′ in diameter, stout ascending branches forming a broad open irregular head, and slender conspicuously zigzag branchlets clothed early in the season with long matted pale hairs, becoming dark orange-brown and very lustrous before midsummer, glabrous or puberulous during their first winter, bright orange-

brown or gray-brown during their second year, and armed with many stout straight or slightly curved bright chestnut-brown shining spines $2\frac{1}{2}'$–$3'$ long.

Distribution. Thickets on a dry bank in the Arnold Arboretum, valley of the Mystic River at West Medford, Middlesex County, Massachusetts, and near Lyme, New London County, Connecticut.

Often cultivated in the parks and gardens in the neighborhood of Boston; very conspicuous and easily recognized in winter by its ascending remarkably zigzag branchlets.

87. Cratægus champlainensis Sarg.

Leaves ovate, acute, rounded, truncate, slightly cordate or broad-cuneate at base, usually divided into 2 or 3 pairs of short narrow acute lobes, and coarsely often doubly serrate with glandular teeth, roughened above by short pale hairs and villose below when they unfold, nearly fully grown when the flowers open early in June, and at maturity thick and firm in texture, conspicuously blue-green and glabrous above, light yellow-green and somewhat pubescent below on the slender midrib and remote primary veins, $2'$–$2\frac{1}{2}'$ long,

Fig. 439

and $1'$–$1\frac{1}{2}'$ wide; petioles slender, more or less tomentose early in the season, usually becoming glabrous and light red below the middle before autumn, and $\frac{3}{4}'$–$1'$ in length; leaves at the end of vigorous shoots broad-ovate, rounded or slightly cordate at base, more deeply lobed, and often $3'$–$4'$ long and wide. **Flowers** $\frac{3}{4}'$ in diameter, on short slender densely villose pedicels, in compact few-flowered densely villose corymbs; calyx-tube narrowly obconic, coated with thick hoary tomentum, the lobes lanceolate, finely glandular-serrate, tomentose on the outer surface usually only below the middle, villose on the inner surface; stamens 10; anthers small, light yellow; styles 5, surrounded at base by tufts of pale hairs. **Fruit** ripening early in September and usually remaining on the branches during the remainder of the year, on short slightly pubescent pedicels, in compact erect villose clusters, obovoid to short-oblong, bright scarlet, marked by scattered pale dots, more or less villose or pubescent toward the ends; calyx prominent, persistent, with a long tube, the lobes gradually narrowed from a broad base, acuminate, finely glandular-serrate, villose, dark red on the upper side below the middle, spreading or erect; flesh thick, yellow, dry and mealy; nutlets 5, ridged on the back with a broad ridge, $\frac{5}{16}'$ long.

A tree, 15°–20° high, with a tall trunk $8'$–$10'$ in diameter, covered with deeply fissured bark separating into thin loose plate-like scales, stout wide-spreading branches forming a broad round-topped often symmetrical head, and slender somewhat zigzag branchlets coated early in the season with hoary tomentum, soon becoming glabrous and light chest-

nut-brown and lustrous, and armed with straight or slightly curved chestnut-brown spines $1\frac{1}{2}'$–$2'$ long.

Distribution. Limestone ridges; valley of the St. Lawrence River near Montreal, Province of Quebec, southward through the Champlain valley to eastern New York and westward through New York, and southern Ontario to the neighborhood of Toronto.

88. Cratægus pennsylvanica Ashe.

Leaves ovate, acuminate, rounded or abruptly cuneate at base, coarsely often doubly serrate with straight glandular teeth, and slightly divided into 3 or 4 pairs of short broad acuminate lobes, slightly tinged with red when they unfold, more than half grown when the flowers open the middle of May and then thin, dark yellow-green and roughened above by short white hairs and villose on the prominent midrib and primary veins below, and at maturity thin, dark yellow-green and scabrate on the upper surface, paler, scabrate and still somewhat villose on the midrib and veins below, $2\frac{1}{2}'$–$3\frac{1}{2}'$ long, and $2'$–$2\frac{3}{4}'$ wide; petioles slender, slightly wing-margined at apex, villose through the season, occasionally glandular.

Fig. 440

$1\frac{1}{4}'$–$1\frac{1}{2}'$ in length; leaves at the end of vigorous shoots rounded or truncate at base, coarsely serrate, more deeply lobed, and often $4'$–$4\frac{1}{2}'$ long and broad, with a stout midrib, prominent primary veins, a conspicuously glandular petiole, and large foliaceous lunate coarsely glandular-serrate persistent stipules. **Flowers** $\frac{3}{4}'$–$1'$ in diameter, on slender densely villose pedicels in broad lax hairy mostly 8–15-flowered corymbs; calyx-tube narrowly obconic, covered with long white hairs, the lobes long, slender, acuminate, laciniately glandular-serrate, glabrous on the outer surface, villose on the inner surface; stamens 8–12; anthers faintly tinged with pink; styles 3–5. **Fruit** ripening and falling early in October, on short stout drooping slightly hairy pedicels, in 4–12-fruited clusters, short-obovoid, full and rounded at apex, bright orange-red marked by small pale dots, puberulous at the ends, $\frac{3}{4}'$–$1'$ in diameter; calyx little enlarged, with small spreading lobes dark red on the upper side, their tips often deciduous from the ripe fruit; flesh thick, orange-yellow, somewhat acidulous, edible, sometimes made into jelly; nutlets 3–5, rounded at apex, acute at base, rounded and slightly grooved or ridged on the back, about $\frac{1}{3}'$ long.

A tree, sometimes 30° high, with a tall trunk often 18′ in diameter, covered with dark gray scaly bark, large spreading branches forming a wide symmetrical round-topped head, and stout slightly zigzag branchlets dark orange-green and more or less tinged with red when they first appear, becoming dark chestnut-brown, marked by large dark lenticels and more or less pubescent in their first season, dark red-brown the following year, and armed with stout straight or slightly curved chestnut-brown spines $1'$–$1\frac{1}{2}'$ long.

Distribution. Meadows in low moist soil near Pittsburgh, Allegheny County, Pennsylvania.

89. Cratægus submollis Sarg.

Leaves ovate, acute, gradually narrowed and cuneate at the nearly entire base, coarsely doubly serrate above with straight glandular teeth, and divided into 3 or 4 pairs of short acute lobes, half grown at the end of May or early in June when the flowers open and then roughened above by short stiff pale hairs and soft-pubescent below, particularly on the midrib and veins, and at maturity thin, dark yellow-green and scabrate above, pale below, 3′–3½′ long, and 2′–2½′ wide, with a thick yellow midrib and remote primary veins puberulous on the lower side; petioles stout, nearly terete, more or less winged at apex, tomentose early in the season, becoming puberulous, often bright red toward the base, 1′–2′ in length; leaves at the end of vigorous shoots broad-ovate, cuneate, rounded, truncate, or occasionally slightly cordate at base, often 4′ long and 3′–3½′ wide. **Flowers** 1′ in diameter, on long slender villose pedicels, in broad many-flowered tomentose corymbs; calyx-tube narrowly obconic, covered with a thick coat of long matted white hairs, the lobes gradually narrowed from a broad base, acute, glandular with large red stipitate glands, glabrous or villose on

Fig. 441

the outer surface; stamens 10; anthers small, pale yellow; styles 3–5, surrounded at base by a narrow ring of long white hairs. **Fruit** ripening and falling during the first half of September, on elongated slender slightly villose pedicels, in broad gracefully drooping many-fruited clusters, obovoid, bright orange-red, lustrous, marked by large scattered pale dots, puberulous toward the base, about ¾′ long; calyx much enlarged, with erect coarsely glandular-serrate persistent lobes; flesh yellow, thin, subacid, dry and mealy; nutlets usually 5, rounded and slightly ridged on the back, about ½′ in length.

A tree, 20°–25° high, with a tall trunk occasionally a foot in diameter, ascending or spreading ashy gray branches forming a broad handsome head, and branchlets dark green and coated with hoary tomentum when they first appear, light or dark orange-brown and slightly tomentose at midsummer, becoming glabrous, lustrous, and light red-brown or dark orange-brown, and armed with numerous thin straight or somewhat curved bright chestnut-brown shining spines 2½′–3′ in length.

Distribution. Rich damp hillsides and the borders of woods and roads; valley of the St. Lawrence River from the Isle of Orleans westward; Hull County, Province of Quebec; near Ottawa, Ontario; valley of the Penobscot River and Gerrish Island, Maine to the coast of eastern Massachusetts.

90. Cratægus Ellwangeriana Sarg.

Leaves oval, acute, rounded or broad-cuneate at the entire base, irregularly divided usually only above the middle into numerous short acute lobes, and coarsely and often

doubly serrate above with straight or incurved glandular teeth, about half grown when the flowers open the middle of May, and then roughened above by short pale hairs and villose below on the slender midrib and primary veins, and at maturity thin, light green and scabrate on the upper surface, pale and nearly glabrous on the lower surface, $2\frac{1}{2}'$–$3\frac{1}{2}'$ long, and 2′–3′ wide; petioles slender, villose early in the season, finally glabrous, $1\frac{1}{2}'$–2′ in length; stipules oblong-obovate, acute, villose, coarsely glandular-serrate, $\frac{1}{2}'$ long, those of the upper leaves mostly persistent until after the ripening of the fruit. **Flowers** 1′ in diameter, on short stout hairy pedicels, in many-flowered densely villose corymbs; calyx-tube broadly obconic, villose, the lobes long, lanceolate, glandular with small pale stalked glands, villose on both surfaces; stamens 10, sometimes 8; anthers small, rose color; styles 3–5. **Fruit** ripening and falling at the end of September, on slender glabrous pedicels, in drooping villose many-fruited crowded clusters, short-oblong, full and rounded at the ends, bright crimson, lustrous, covered at the ends with scattered pale hairs, 1′ long, and $\frac{1}{2}'$–$\frac{3}{4}'$ in diameter; calyx little enlarged, the lobes elongated, glandular-serrate above the middle,

Fig. 442

villose on the inner surface, spreading, or erect and incurved; flesh thin, yellow, juicy and acid; nutlets 3–5, thick, pale brown, deeply and often doubly and irregularly grooved on the back, $\frac{1}{4}'$–$\frac{1}{3}'$ long.

A tree, sometimes 20° high, with a tall trunk often a foot in diameter, covered with pale gray scaly bark, stout ascending branches forming a broad symmetrical head, and slender zigzag branchlets dark green and clothed at first with long matted pale hairs, becoming in their first summer light chestnut-brown and slightly villose, dark chestnut-brown and very lustrous in their second year, and armed with stout straight or somewhat curved dark chestnut-brown shining spines $1\frac{1}{2}'$–2′ long.

Distribution. Western New York (common) to western Pennsylvania, and through southern Ontario to southern Michigan.

91. Cratægus Robesoniana Sarg.

Cratægus spissiflora Sarg.

Leaves oblong-ovate, acute or acuminate at apex, rounded broadly cuneate or rarely cordate at the entire base, sharply doubly serrate above with slender straight gland-tipped teeth, and deeply divided into numerous broad acute or acuminate lateral lobes, villose above and densely tomentose below when they unfold, about half grown when the flowers open at the end of May and then roughened above by short rigid white hairs and pubescent

below on the midrib and veins, and at maturity dark yellow-green and scabrate on the upper surface, glabrous on the lower surface, 3′–3½′ long, and 2½′–3′ wide, with a slender midrib, and 4 or 5 pairs of prominent veins extending obliquely to the point of the lobes; petioles slender, more or less wing-margined at apex, slightly grooved, sparingly glandular, villose early in the season, becoming glabrous and rose color in the autumn, 1¼′–1½′ in length; leaves at the end of vigorous shoots cordate or rarely cuneate at base, deeply lobed, often 4′ long and 3½′ wide, with a stout conspicuous glandular petiole. **Flowers** ⅔′ in diameter, on short slender villose pedicels, in small very compact few, usually 4–6-flowered, thin-branched villose corymbs, with oblong-obovate acuminate glandular bracts and bractlets mostly deciduous before the flowers open; calyx-tube narrowly obconic, coated with long matted white hairs, the lobes slender, acuminate, finely glandular-serrate, glabrous on the outer surface, villose on the inner surface; stamens 10; anthers dark rose color; styles 4 or 5, surrounded at base by a narrow ring of pale tomentum. **Fruit** ripening at the end of September or early in October, on short reddish pubescent pedicels, in compact drooping clusters, oblong-obovoid to short-oblong, scarlet, lustrous, marked by small pale

Fig. 443

dots, about ¾′ long, and ½′ in diameter; calyx little enlarged, with spreading sharply serrate lobes often deciduous from the ripe fruit; flesh thick, yellow, dry and mealy; nutlets 4 or 5, thin, acute at the ends, rounded or only slightly grooved on the back, about ⅝′ in length.

A tree, 20°–25° high, with a trunk often 1° in diameter, covered with smooth pale gray bark, and stout spreading branches forming a round-topped head, and stout slightly zigzag dark red-brown branchlets sparingly villose early in the season, soon glabrous, bright red-brown, very lustrous and marked by small pale lenticels at the end of their first season, becoming dark gray or gray-brown the following year, and armed with few stout spreading bright chestnut-brown shining ultimately gray spines 1′–1½′ long.

Distribution. Western Massachusetts through central and western New York to the neighborhood of Toronto, southern Ontario.

92. Cratægus anomala Sarg.

Leaves ovate, acute, divided above the middle into 5 or 6 pairs of short acute or acuminate lobes, and coarsely doubly serrate with spreading glandular teeth except toward the broad-cuneate or occasionally rounded base, when they unfold conspicuously plicate, covered above with short appressed pale hairs, and villose below, especially on the slender midrib, and thin remote primary veins arching to the point of the lobes, about a third grown when the flowers open at the end of May, and at maturity membranaceous, light

yellow-green, smooth and glabrous above, paler and villose below, $2\frac{1}{2}'$–$3'$ long, and $2'$–$3'$ wide; petioles stout, glandular on the upper side with scattered dark glands, $\frac{3}{4}'$–$1'$ in length; leaves at the end of vigorous shoots, rounded or truncate at base, and often $4'$–$4\frac{1}{2}'$ long and $2\frac{1}{2}'$–$3'$ wide. **Flowers** saucer-shaped, $\frac{1}{2}'$ in diameter when fully expanded, on elongated slender hairy pedicels, in broad loose many-flowered villose corymbs; calyx-tube narrowly obconic, coated with long matted pale hairs, the lobes long, acuminate, coarsely glandular-serrate, pubescent on the outer surface and tomentose on the inner surface; stamens usually 10, occasionally 7 or 8; anthers large, bright red; styles 4 or 5, surrounded at base by a narrow ring of pale tomentum. **Fruit** ripening in October, on long slender slightly pubescent pedicels, in loose many-fruited sparingly villose clusters, obovoid to oblong, gradually narrowed to the rounded base, crimson, lustrous, marked by large pale dots, slightly villose, particularly toward the full and rounded apex, $\frac{3}{4}'$–$\frac{7}{8}'$ long, $\frac{1}{2}'$–$\frac{5}{8}'$ in diameter; calyx large and prominent, with elongated acuminate lobes abruptly narrowed from a broad base, dark red on the upper side, tomentose on the lower, finely glandular-serrate, spreading or closely

Fig. 444

appressed, often deciduous before the ripening of the fruit; flesh thin, light yellow, somewhat juicy; nutlets 4 or 5, thin, prominently and irregularly ridged on the back, $\frac{1}{4}'$–$\frac{5}{8}'$ long.

A bushy tree, sometimes 20° high, with a short trunk $6'$ in diameter, covered with pale gray-brown scaly bark, stout ascending branches, and slender somewhat zigzag branchlets at first dark green and villose with long matted white hairs, puberulous and light orange-brown during their first season, becoming glabrous and orange-brown or bright red, and armed with numerous stout straight or slightly curved bright chestnut-brown spines $1\frac{1}{4}'$–$2'$ long.

Distribution. Low limestone ridges near the banks of the St. Lawrence River in the Caughnawaga Indian Reservation opposite Lachine in the Province of Quebec; western Vermont (Clarendon, Rutland County); Crown Point, Essex County, and Fort Ann, Washington County, New York.

93. Cratægus noelensis Sarg.

Leaves ovate to oval, acute, acuminate or rarely rounded at apex, acutely or broadly cuneate at base, and coarsely doubly serrate with straight teeth, covered above with short white hairs and densely villose-pubescent below when they unfold, more than half grown when the flowers open at the end of April, and at maturity dark yellow-green, smooth and glabrous on the upper surface, villose-pubescent on the lower surface, $2'$–$3'$ long, and $1\frac{1}{4}'$–$2\frac{1}{2}'$ wide, with a prominent midrib and thin conspicuous primary veins; petioles slender, slightly wing-margined at apex, hoary-tomentose early in the season, becoming glabrous,

1′–1¼′ in length; leaves at the end of vigorous shoots ovate, acuminate, rounded or cuneate at the broad base, more coarsely serrate, usually laterally lobed with short broad acuminate lobes, 3′–4′ long, and 2½′–3′ wide. **Flowers** ¾′ to nearly 1′ in diameter, on short pedicels densely covered like the narrow obconic calyx-tube and the compact 5–10-flowered corymb with long matted white hairs; calyx-lobes slender, long-acuminate, minutely glandular-serrate, slightly villose; stamens 5–10, usually 10; anthers rose color; styles 3–5, surrounded at base by a broad ring of pale tomentum. **Fruit** ripening in September, on slender drooping pubescent pedicels, subglobose, orange-red, ½′–⅔′ in diameter, the calyx prominent with a short tube and spreading closely appressed lobes; flesh thin, soft and yellow; nutlets 3–5, rounded at base, narrowed and rounded at apex, slightly grooved on the back, about ¼′ long.

Fig. 445

A tree, 15°–18° high, with a trunk sometimes 1° in diameter, spreading branches forming a broad flat or round-topped head, and stout zigzag branchlets coated when they first appear with matted white hairs, reddish brown, pubescent or puberulous during their first season and gray the following year, and armed with few or many slender straight purple lustrous spines 1′–2½′ in length, sometimes persistent and compound on old trunks.

Distribution. Rich alluvial soil; in the neighborhood of Noel, McDonald County, and Galena, Stone County, Missouri, and to Rogers, Benton County, Arkansas; common.

IX. COCCINEÆ.

Flabellatæ Sarg.

CONSPECTUS OF THE ARBORESCENT SPECIES.

Stamens 20; leaves yellow-green and scabrate above.

Leaves ovate; anthers deep rose-purple; fruit obovoid to short-oblong, bright red, often slightly pruinose. 94. **C. neo-londinensis** (A).

Leaves oblong-ovate; anthers pink; fruit obovoid, crimson, lustrous. 95. **C. Hillii** (A).

Stamens 10–20, usually 10; anthers pinkish purple, leaves broad-ovate, dull dark green and scabrate above; fruit short-oblong to slightly obovoid, dull red or crimson. 96. **C. assurgens** (A).

Stamens usually 10.

Fruit on short stout pedicels; leaves yellow-green and glabrous above.

Leaves oval, drooping, conspicuously concave; anthers purple; fruit short-oblong, dark dull red, villose at the ends. 97. **C. Pringlei** (A).

Leaves oval to oblong-ovate; anthers dark reddish purple; fruit short-oblong, crimson, lustrous. 98. **C. lobulata** (A).

Fruit on long slender pedicels; leaves broad-ovate to obovate or rhombic, dark rich

green and scabrate above; anthers rose color; fruit short-oblong, bright scarlet, lustrous. 99. **C. pedicellata** (A).

Stamens usually 5–7, rarely 10.

Fruit obovoid to ellipsoidal; leaves oval or ovate, conspicuously yellow-green; anthers dark reddish purple; fruit crimson, lustrous. 100. **C. Holmesiana** (A).

Fruit short-oblong; leaves oblong-ovate, deep yellow-green, nearly smooth above; anthers pink; fruit yellowish red, glaucous. 101. **C. acclivis** (A).

Fruit subglobose to obovoid.

Leaves glabrous above; anthers dark rose color.

Leaves broad-ovate, thin, light yellow-green and lustrous above; fruit bright red or scarlet. 102. **C. delecta** (A).

Leaves oblong-ovate, subcoriaceous, dark dull green; fruit bright cherry-red, pruinose. 103. **C. Eamesii** (A).

Leaves scabrate above, oblong-ovate, thin, dark yellow-green; anthers pale rose color; fruit crimson. 104. **C. sertata** (A).

94. Cratægus neo-londinensis Sarg.

Leaves ovate, acute or acuminate, rounded, truncate or broadly concave-cuneate at the wide entire or glandular base, sharply often doubly serrate above with straight glandular teeth, and divided into numerous short narrow acuminate lateral lobes, about half grown

Fig. 446

when the flowers open the middle of May and then very thin, light yellow-green and roughened above by short white rigid hairs and paler and sparingly hairy below, and at maturity membranaceous, dull yellow-green and scabrate on the upper surface, pale green and glabrous below, or occasionally slightly hairy on the under side of the stout yellow midrib, and of the thin remote primary veins arching to the point of the lobes, 3′–4′ long, and $2\frac{1}{2}$′–$3\frac{1}{2}$′ wide; petioles slender, nearly terete, glandular, at first slightly hairy, becoming glabrous and purplish toward the base, 1′–2′ in length; leaves at the end of vigorous shoots only slightly larger. **Flowers** 1′–$1\frac{1}{8}$′ in diameter, on slender sparingly villose pedicels, in lax slightly drooping usually 5–12-flowered villose or nearly glabrous corymbs, with linear often slightly falcate glandular bracts and bractlets, persistent until after the flowers open; calyx-tube narrowly obconic, covered with short matted pale hairs, the lobes gradually narrowed from a broad base, acuminate, coarsely glandular-serrate below the middle, glabrous on the outer, villose on the inner surface; stamens 17–21, usually 20; anthers deep rose-purple; styles 4 or 5, usually 5, surrounded at base by a narrow ring of pale tomentum.

Fruit ripening and beginning to fall early in September, on stout villose or glabrous pedicels, in large drooping few-fruited clusters, obovoid or short-oblong, bright red, often slightly pruinose, marked by numerous minute pale dots, $\frac{5}{8}'$–$\frac{3}{4}'$ long, $\frac{1}{2}'$–$\frac{5}{8}'$ in diameter; calyx enlarged, prominent, with spreading or erect and incurved coarsely serrate persistent lobes, their upper surface bright red below the middle and covered above with soft white hairs; flesh thick, orange-yellow, soft, juicy and acidulous; nutlets 4 or 5, thin, narrowed at the ends, acute at base, rounded at apex, rounded and sometimes broadly grooved on the back, about $\frac{5}{16}'$ long.

A tree, often 20° high, with a tall trunk 8′–10′ in diameter, covered with light grayish brown slightly fissured bark, large spreading and drooping branches forming an open head often 20° across, and slender branchlets olive-green and slightly hairy when they first appear, dull red-brown and marked by many large pale lenticels during their first season, becoming light gray and rather lustrous, and armed with stout straight dark purple shining ultimately gray spines often 2′ long.

Distribution. Borders of woods near the shores of Fisher's Island Sound, Mumford's Point, Groton, and near Lyme, New London County, Connecticut.

95. Cratægus Hillii Sarg.

Leaves oblong-ovate, acuminate, rounded or rarely cuneate at the broad entire base, coarsely doubly serrate above with straight glandular teeth, and divided into numerous short acuminate lateral lobes, when they unfold coated above with short lustrous white

Fig. 447

hairs and densely tomentose below, particularly on the midrib and veins, about one fourth grown when the flowers open the middle of May and then roughened above by short hairs and villose below, and at maturity thin, light yellow-green and scabrate on the upper surface, pale yellow-green on the lower surface, $2\frac{1}{2}'$–$3'$ long, and $2'$–$2\frac{1}{2}'$ wide, with a slender midrib often slightly hairy near the base, and 4 or 5 pairs of thin primary veins extending obliquely to the point of the lobes; petioles slender, densely villose early in the season, slightly hairy in the autumn, and $\frac{5}{8}'$–$1\frac{1}{2}'$ in length; leaves at the end of vigorous shoots often truncate or slightly cordate at base, deeply lobed with broad triangular lobes, and $3\frac{1}{2}'$–$4'$ long and wide, with a stout rose-colored glandular petiole, and hairy lunate glandular-serrate stipules. **Flowers** about $\frac{3}{4}'$ in diameter, on slender densely villose pedicels, in broad many-flowered hairy compound corymbs, their large linear to oblong bracts and bractlets occasionally persistent until midsummer; calyx-tube narrowly obconic, thickly covered with long spreading white hairs, the lobes abruptly narrowed at base, broad,

acuminate, coarsely glandular-serrate, glabrous on the outer surface, villose on the inner surface; stamens 20; anthers pink; styles 4 or 5, surrounded at base by a narrow ring of pale tomentum. **Fruit** ripening from the middle to the end of September, on slender puberulous pedicels, in drooping few-fruited clusters, obovoid, broad and rounded at apex, gradually narrowed to the rounded base, crimson, lustrous, marked by small pale dots, $\frac{1}{2}'$–$\frac{5}{8}'$ long, $\frac{3}{8}'$–$\frac{1}{2}'$ in diameter; calyx only slightly enlarged, with closely appressed coarsely serrate lobes often deciduous from the ripe fruit; flesh yellow, thin, acidulous, juicy; nutlets 4 or 5, thin, gradually narrowed and acute at the ends, irregularly ridged and sometimes grooved on the back, about $\frac{3}{8}'$ long.

A tree, 25°–30° high, with a trunk sometimes a foot in diameter and 6° or 7° long, covered with close light gray bark tinged with red and divided by shallow fissures into small plates, stout ascending branches forming an open irregular often round-topped head, and slender nearly straight branchlets densely villose when they first appear, dark orange color tinged with red and sparingly villose when the flowers open, becoming bright red-brown and lustrous at the end of their first season and dark dull reddish brown the following year, and sparingly armed with slender nearly straight red-brown shining spines $1\frac{1}{2}'$–$2'$ long.

Distribution. Open woods near the borders of streams in moist rich soil; northeastern Illinois, (Thatcher's Park, Glendon Park, and River Forest, Cook County); not common.

96. Cratægus assurgens Sarg.

Leaves broad-ovate, acuminate, rounded or rarely cuneate at the wide entire base, sharply doubly serrate above with straight gland-tipped teeth, and slightly divided, into 3 or 4 pairs of small acuminate lobes, about one third grown when the flowers open

Fig. 448

the middle of May and then roughened above by short white hairs and glabrous or sparingly villose below, with persistent hairs on the slender yellow midrib, and on the veins arching obliquely to the point of the lobes, and at maturity membranaceous, dull dark green and scabrate on the upper surface, light yellow-green on the lower surface, $2\frac{3}{4}'$–$3\frac{1}{2}'$ long, and $2\frac{1}{4}'$–$2\frac{3}{4}'$ wide; petioles slender, villose early in the season, becoming pubescent $1'$–$1\frac{1}{2}'$ in length; leaves at the end of vigorous shoots often deeply lobed, coarsely serrate sometimes 4′ long and wide, with long stout glandular petioles and foliaceous lunate acuminate coarsely glandular-serrate persistent stipules. **Flowers** $\frac{3}{4}'$–$\frac{5}{8}'$ in diameter, on short villose pedicels, in compact 8–15-flowered hairy corymbs, with oblong, acuminate, glandular bracts and bractlets, deciduous with the opening of the flowers; calyx-tube narrowly obconic, sparingly villose, the lobes long, narrow, acuminate, tipped with minute red

glands, finely glandular-serrate, glabrous on the outer, pubescent on the inner surface; stamens 10–20, usually 10; anthers pinkish purple; styles 4 or 5, surrounded at base by tufts of pale hairs. **Fruit** ripening from the 15th to the 20th of September, and usually falling about the 1st of October, on short glabrous pedicels, in drooping few-fruited clusters, short-oblong to slightly obovoid, dull red to crimson, $\frac{1}{2}'$–$\frac{5}{8}'$ long, about $\frac{1}{2}'$ wide; calyx sessile, with spreading closely appressed serrate usually persistent lobes; flesh thin, pale yellow or nearly white, acidulous; nutlets 4 or 5, broad, narrow and acute at the ends, prominently ridged on the back with a high narrow ridge, or often grooved, about $\frac{1}{4}'$ long.

A tree, sometimes 25° high, with a trunk 2′–6′ in diameter and often 6°–9° long, covered with close dark gray bark, ascending branches forming an oblong, open head, and slender branchlets light orange-yellow and covered when they first appear with long scattered caducous white hairs, becoming bright red-brown and lustrous, and dark gray-brown the following year, and armed with many stout usually slightly curved bright red-brown shining spines, 1′–$1\frac{1}{2}'$ long.

Distribution. River banks and low woods in rich soil; northeastern Illinois (Leyden township, La Grange, Thatcher's Park, Cook County, Highland Park, Deerfield, Wauconda, Lake County); Fox Point, Milwaukee County, Wisconsin.

97. Cratægus Pringlei Sarg.

Leaves oval, acute, rounded or often abruptly narrowed and cuneate at base, occasionally irregularly lobed above the middle with short broad acute lobes, and coarsely and often doubly serrate with glandular teeth, as they unfold villose on both surfaces, and often

Fig. 449

more or less tinged with red, when the flowers open, usually in the last week of May, roughened above by short closely appressed pale hairs and glabrous below with the exception of a few hairs on the slender midrib and remote primary veins, and at maturity thin, glabrous, and bright yellow-green on the upper surface, pale below, 2′–$2\frac{1}{2}'$ long, and $1\frac{3}{4}'$–$2\frac{1}{4}'$ wide, usually conspicuously concave by the gradual turning down of the blades from the midrib to the margins, drooping on long thin slender glandular petioles at first villose, ultimately glabrous, 1′–$1\frac{3}{4}'$ in length; leaves at the end of vigorous shoots sometimes truncate or slightly cordate at the base, and frequently 3′ long and wide. **Flowers** about $\frac{3}{4}'$ in diameter, on stout hairy pedicels, in many-flowered compound villose corymbs; calyx-tube narrowly obconic, villose, particularly toward the base, the lobes narrow, acuminate, coarsely glandular-serrate, villose on both surfaces or only on the inner surface; stamens 10, occasionally 5–10; anthers small, purple; styles 3–5, surrounded at the base by con-

spicuous tufts of pale tomentum. **Fruit** ripening and falling late in September or early in October, on stout pedicels, in erect villose mostly few-fruited clusters, short-oblong, dark dull red, marked by few dark dots, villose at the ends with long scattered pale hairs, $\frac{3}{4}'$ long and $\frac{5}{8}'$ in diameter; calyx little enlarged, the lobes gradually narrowed from a broad base, acuminate, glandular-serrate, often erect; flesh thick, yellow, dry and acid, with a disagreeable flavor; nutlets 3–5, rounded and slightly ridged on the back, $\frac{1}{3}'$ long.

A tree, occasionally 25° high, with a tall trunk 10′–12′ in diameter, covered with thin bark separating into large flakes broken into small loose dark red-brown scales, stout branches forming a wide symmetrical head, and slightly zigzag branchlets at first dark green and villose, soon becoming glabrous, chestnut-brown and lustrous, bright orange-brown during their second year, and armed with thick straight or somewhat curved chestnut-brown spines often $1\frac{1}{2}'$ long.

Distribution. Southern New Hampshire, through southern Vermont to western Massachusetts and eastern New York; through central and western New York and southern Ontario to northeastern Ohio (Plymouth, Ashtabula County), the southern peninsula of Michigan and northeastern Illinois.

98. Cratægus lobulata Sarg. Red Haw.

Leaves oval to oblong-ovate, acute at apex, broad-cuneate or rounded at the entire base, sharply and often doubly serrate above with straight glandular teeth, and deeply divided into numerous narrow acute or acuminate lobes spreading or pointing to the apex

Fig. 450

or to the base of the leaf, when they first appear and until after the opening of the flowers during the last week in May covered above with short soft pale hairs and slightly pubescent below on the slender midrib, and thin primary veins arching to the point of the lobes, and at maturity thin, dark yellow-green and glabrous on the upper surface, paler on the lower surface, with occasional short white hairs toward the base of the midrib, $2\frac{1}{2}'$–$3\frac{1}{2}'$ long and 2′–$2\frac{1}{2}'$ wide; petioles slender, nearly terete, at first tomentose, particularly at the base, becoming pubescent or nearly glabrous and bright red, 1′–$1\frac{1}{2}'$ in length; leaves at the end of vigorous shoots broad-ovate, rounded or truncate at the broad base, divided into numerous acuminate lateral lobes, often $3\frac{1}{2}'$–4′ long and 3′–$3\frac{1}{2}'$ wide. **Flowers** $\frac{3}{4}'$ in diameter, on elongated slender pedicels, in rather compact many-flowered tomentose corymbs, with linear-lanceolate glandular-serrate bright red bracts and bractlets; calyx-tube broadly obconic, glabrous, or villose toward the base, dark red, the lobes gradually narrowed from a broad base, glabrous, coarsely glandular-serrate with large dark red stipitate glands; stamens usually 10, occasionally 5–10; anthers small, dark reddish purple; styles

3–5, sometimes surrounded at the base by a ring of pale tomentum. **Fruit** ripening and falling early in October, on short stout pedicels, in erect compact tomentulose clusters, short-oblong, somewhat flattened at the rounded ends, bright crimson, very lustrous, marked by occasional small white dots, about $\frac{3}{4}'$ long and $\frac{5}{8}'$ in diameter; calyx little enlarged, the lobes small, lanceolate, coarsely glandular-serrate, tomentose on the upper surface, erect and incurved, persistent; flesh thick, yellow, sweet and juicy; nutlets 3–5, thin, dark colored, ridged and often grooved on the back, $\frac{1}{4}'$ long.

A tree, occasionally 35° high, with a straight trunk often a foot in diameter, covered with dark red-brown fissured bark broken into small thick plate-like scales, stout generally ascending branches forming an open usually narrow irregular head, and slender branchlets, dark green and covered with matted pale hairs when they first appear, becoming bright chestnut-brown and very lustrous during their first season, and light orange-brown the following year, and armed with many stout nearly straight chestnut-brown spines rarely more than 1′ in length.

Distribution. Burlington, Chittenden County, Vermont, and southward through the Champlain valley to Crown Point, Essex County and to the neighborhood of Albany, New York; western Massachusetts to southern Connecticut (Stratford, Fairfield County); common.

99. Cratægus pedicellata Sarg.

Leaves broad-ovate or occasionally obovate or rhombic, acute or acuminate, broad-cuneate or rounded at the entire base, coarsely often doubly serrate above with spreading glandular teeth, and divided above the middle into 4 or 5 pairs of short acute or acuminate

Fig. 451

lobes, nearly two thirds grown when the flowers open during the last week in May, and then roughened above by short rigid pale hairs and glabrous below, and at maturity membranaceous, dark rich green and scabrate on the upper surface, pale on the lower surface, 3′–4′ long, and 2′–3′ wide, with a slender midrib, and thin remote primary veins arching to the point of the lobes; petioles slender, nearly terete, glandular with minute scattered dark glands, at first villose, becoming glabrous, $1\frac{1}{2}'$–$2\frac{1}{2}'$ in length; leaves at the end of vigorous shoots sometimes truncate or slightly cordate at base, more deeply lobed, often 3′–4′ long and 3′ wide. **Flowers** $\frac{1}{2}'$ in diameter, on long thin pedicels, in loose lax many-flowered slightly villose corymbs; calyx-tube narrowly obconic, glabrous, the lobes broad, acute, very coarsely glandular-serrate; stamens usually 10; anthers rose color; styles 5, surrounded at base by a conspicuous ring of pale tomentum. **Fruit** ripening and falling during September, on long slender pedicels, in few-fruited drooping glabrous clus-

ters, obovoid until nearly fully grown, becoming short-oblong when fully ripe, rounded at the ends, bright scarlet, lustrous, marked by numerous small dark dots, $\frac{3}{4}'$ long, and $\frac{1}{2}'$–$\frac{5}{8}'$ in diameter; calyx large and conspicuous, the lobes much enlarged, coarsely serrate, and usually erect and incurved; flesh pale, thin, dry and mealy; nutlets 5, narrowed and acute at the ends, rounded and deeply grooved on the back, about $\frac{1}{3}'$ long.

A tree, 18°–20° high, with a tall trunk sometimes a foot in diameter, covered with close red-brown scaly bark, long comparatively slender spreading or ascending branches forming a handsome symmetrical head, and thin branchlets dark chestnut-brown and slightly villose at first, becoming very lustrous and ashy gray in their second year, and armed with straight or slightly curved shining chestnut-brown spines $1\frac{1}{2}'$–$2'$ long.

Distribution. Central and western New York to western Pennsylvania (Allegheny and Crawford counties), and to southern Ontario to the neighborhood of Toronto and London; common; passing into var. *gloriosa* Sarg. differing in its rather larger flowers with pink anthers, larger and more lustrous fruit often mammillate at base and ripening a few days earlier and in its convex leaves. A tree, 20°–25° high, with a trunk often 1° in diameter, and a symmetrical round-topped head; Rochester, Monroe County, New York; not common.

100. Cratægus Holmesiana Ashe.

Leaves oval or ovate, acute or acuminate at apex, rounded or broad-cuneate at base, coarsely doubly serrate above the middle with straight teeth tipped at first with prominent dark red caducous glands, and usually divided into 3 or 4 pairs of short acute or acu-

Fig. 452

minate lateral lobes, when they unfold dark red, roughened by rigid pale hairs on the upper surface, and glabrous or sometimes villose on the lower surface, scabrate above, pale yellow-green and nearly half grown when the flowers open early in May, and at maturity thick and firm, almost smooth, conspicuously yellow-green, usually about $2'$ long and $1\frac{3}{4}'$ wide, with a prominent midrib often bright red on the lower side toward the base, and 4–6 pairs of slender primary veins arching to the point of the lobes; petioles slender, nearly terete, glandular, glabrous or sometimes puberulous while young, $1'$–$1\frac{1}{2}'$ in length; leaves at the end of vigorous shoots often broad-ovate to oval, rounded, truncate or slightly cordate at base, more coarsely serrate and more deeply lobed, and frequently $4'$ long and $3'$ wide. **Flowers** cup-shaped, $\frac{1}{2}'$–$\frac{3}{4}'$ in diameter, on long slender glabrous pedicels, in loose glabrous or rarely puberulous many-flowered corymbs, with oblanceolate or linear acute glandular caducous bracts and bractlets; calyx-tube narrowly obconic, glabrous, more or less deeply tinged with red, the lobes long, acuminate, glandular-serrate, or often nearly

entire; glabrous on the outer surface, villose-pubescent on the inner surface; stamens usually 5, sometimes 6–8; anthers large, dark reddish purple; styles usually 3, surrounded at base by a narrow ring of pale tomentum. **Fruit** ripening and falling early in September, on long slender pedicels, in many-fruited drooping clusters, obovoid to ellipsoidal, crimson, lustrous, marked by occasional small dark dots, about $\frac{1}{2}'$ long, and $\frac{1}{3}'$ in diameter; calyx enlarged, conspicuous, with erect and incurved glandular-serrate lobes, bright red toward the base on the upper side; flesh thin, yellow, dry and mealy, with a disagreeable flavor; nutlets usually 3, light chestnut-brown, prominently grooved and ridged on the back with a broad rounded ridge, about $\frac{1}{4}'$ long.

A tree, often 30° high, with a tall straight trunk 10′–15′ in diameter, covered with pale gray-brown or nearly white scaly bark, stout ascending branches forming an open irregular rather compact head, and stout glabrous branchlets dark green more or less tinged with red when they first appear, becoming bright chestnut-brown or orange-brown and lustrous, and ultimately ashy gray, and armed with occasional thick mostly straight bright chestnut-brown shining spines $1\frac{1}{2}'$–2′ long.

Distribution. Rich moist hillsides and the borders of streams and swamps, neighborhood of Montreal and southern Ontario to the coast of southern Maine, central and western Massachusetts, Rhode Island, western New York, and eastern Pennsylvania; most abundant and of its largest size on the hills of Worcester County, Massachusetts. In Sellersville, Bucks County, Pennsylvania, in a form of this species (var. *villipes* Ashe) the young branchlets, petioles, and corymbs are often puberulous and the under surface of the leaves more or less hairy, especially on the midrib and veins. Passing into var. *tardipes* Sarg. differing from the type in its darker green leaves somewhat rougher on the upper surface, flowers often $\frac{3}{4}'$ in diameter on villose pedicels, and in the shorter slightly hairy pedicels of the fruit ripening early in October.

A tree, in size, habit and bark similar to the species; southern Ontario (neighborhood of Toronto, common, near London, bank of the St. Clair River below Sarnia and Walpole Island, Lamberton County); Province of Quebec (Montreal, Caughnawaga, Isle Perrot, St. Ann's and Hemmingford); central and western New York.

101. Cratægus acclivis Sarg.

Leaves oblong-ovate, acuminate, broad-cuneate or rounded at the entire base, coarsely doubly serrate above with straight gland-tipped teeth, and deeply divided into numerous wide-spreading acuminate lateral lobes, when they unfold tinged with red, densely villose on the upper surface, pubescent on the midrib and veins below, about half grown when the flowers open during the last week of May and then light yellow-green, slightly roughened above by short white hairs and pubescent on the midrib and veins below, and at maturity membranaceous, dark yellow-green and nearly smooth above, pale yellow-green and glabrous below, $2\frac{1}{2}'$–3′ long, and 2′–$2\frac{1}{2}'$ wide, with a stout yellow midrib, and 5 or 6 pairs of primary veins extending obliquely to the point of the lobes; petioles slender, slightly wing-margined at apex, glandular with numerous small dark glands, densely villose early in the season, becoming puberulous or glabrous in the autumn, $1\frac{1}{2}'$–2′ in length; leaves at the end of vigorous shoots broad-ovate, acuminate, cordate at the wide base, deeply divided into wide acute lateral lobes, and often 4′–5′ long and wide, with foliaceous, lunate, coarsely glandular-serrate stipules, $1\frac{1}{2}'$ wide, and persistent throughout the season. **Flowers** $\frac{3}{4}'$ in diameter, on slender densely villose pedicels, in broad lax many-flowered long-branched hairy corymbs, their bracts lanceolate, glandular, large and conspicuous, persistent until after the flowers open; calyx-tube narrowly obconic, covered with a thick coat of long matted hairs, the lobes long slender, acuminate, serrate with occasional large gland-tipped teeth, glabrous on the outer surface, slightly villose on the inner surface; stamens usually 5; anthers pink; styles mostly 5. **Fruit** ripening the middle of September and soon falling, on long slender slightly hairy pedicels, in many-fruited drooping clusters, short-oblong, broad and rounded at the ends, yellowish red, glaucous, marked by occasional pale dots, about $\frac{3}{4}'$ long and $\frac{5}{8}'$ wide; calyx sessile, with usually erect enlarged coarsely serrate

lobes villose on the upper side and often deciduous from the ripe fruit; flesh thick, yellow, rather juicy; nutlets usually 5, narrow and acute at the ends, ridged with a high broad ridge, or rounded and slightly grooved on the back, about $\frac{5}{8}'$ long.

A tree, 25°–30° high, with a short trunk occasionally 4′–5′ in diameter, covered with smooth light gray bark, numerous erect branches forming an oblong open very irregular

Fig. 453

head, and stout slightly zigzag branchlets coated when they first appear with long matted pale hairs, light red-brown and lustrous, marked by small pale lenticels, and pubescent at the end of their first season, becoming dull red or orange-brown the following year, and armed with stout straight or curved bright red-brown shining spines $1\frac{1}{2}'$–$2'$ long.

Distribution. New York: near Albany, Albany County, steep banks of the gorge of the Genesee River, Rochester, Monroe County, banks of the Niagara River, Niagara Falls, Niagara County, and near Buffalo, Erie County; common.

102. Cratægus delecta Sarg.

Leaves broad-ovate, acute or acuminate at apex, rounded or broad-cuneate at the entire base, sharply often doubly serrate above with straight glandular teeth, and divided usually only above the middle into numerous short acuminate lateral lobes, when they unfold tinged with red and covered with glistening white hairs more abundant below than above, nearly half grown when the flowers open during the first half of May and then roughened on the upper surface by short white hairs and glabrous or sparingly villose on the midrib and veins below with scattered hairs sometimes persistent through the season, and at maturity membranaceous, light yellow-green, lustrous and glabrous above, paler below, $1\frac{1}{2}'$–$2'$ long and wide, with a stout yellow midrib, and 6 or 7 pairs of slender primary veins arching obliquely to the point of the lobes; turning purplish in the autumn before falling; petioles slender, covered early in the season with matted pale hairs, becoming glabrous, slightly glandular, often tinged with red below the middle, $\frac{3}{4}'$–$1'$ in length; leaves at the end of vigorous shoots sometimes long-pointed at apex and slightly cordate at base, more deeply lobed and more coarsely serrate, and often 3′–4′ long and wide. **Flowers** $\frac{3}{4}'$–$1'$ in diameter, on long slender slightly hairy pedicels, in broad villose 10–15-flowered sparingly villose corymbs, with glandular caducous bracts and bractlets; calyx-tube broadly obconic, villose or nearly glabrous, the lobes acuminate, coarsely glandular-serrate, glabrous on the outer surface, villose on the inner surface; stamens 5–10, usually 5; anthers dark rose color; styles 3–5, usually 5. **Fruit** ripening from the first to the middle of September and soon falling, on stout glabrous pedicels, in drooping few-fruited clusters, subglobose to slightly

obovoid, bright red or scarlet, becoming purple when fully ripe, $\frac{1}{2}'$–$\frac{3}{4}'$ long, and $\frac{2}{3}'$–$\frac{3}{4}'$ in diameter; calyx prominent, with erect and incurved coarsely serrate lobes; flesh thick, yellow, juicy, mildly acid and edible; nutlets 3–5, usually 5, narrowed and acute at the ends, rounded and very irregularly ridged on the back, $\frac{1}{4}'$–$\frac{5}{16}'$ long.

A tree, sometimes 30° high, with a trunk rarely 1° in diameter and 6°–9° long, covered with light gray slightly fissured smooth bark, spreading or ascending branches forming an

Fig. 454

oblong open head, and slender branchlets at first slightly villose, becoming glabrous, dull red, and ultimately gray or olive-gray, and armed with stout nearly straight spines much thickened below the middle, dark chestnut-brown and lustrous, becoming dull brown or gray, and usually 1′–2′ long.

Distribution. Pastures, open woods or their borders; northeastern Illinois (Lockport, Will County, Wauconda, Fort Sheridan, Deerfield, Lake Forest, Highland Park, Lake County).

103. Cratægus Eamesii Sarg.

Leaves oblong-ovate, acute or acuminate, concave-cuneate or rounded at the entire or glandular base, sharply often doubly serrate above with straight glandular teeth, and divided into numerous short acute lateral lobes, about half grown when the flowers open the middle of May, and then membranaceous, light yellow-green and roughened above by short rigid white hairs and pale and glabrous below with the exception of a few hairs on the midrib, and slender primary veins arching to the point of the lobes, and at maturity subcoriaceous, glabrous, dark rather dull green and smooth above, pale yellow-green below, 3′–3½′ long, and 2′–2½′ wide; petioles slender, wing-margined above, villose at first, becoming glabrous, 1′–1½′ in length; leaves at the end of vigorous shoots usually rounded or truncate at the broad base, more deeply lobed, often 3½′–4′ long and 3½′ wide. **Flowers** about $\frac{3}{4}'$ in diameter, on slender slightly hairy pedicels, in crowded compact 5–25, usually 15–18-flowered sparingly villose corymbs, with linear-obovate coarsely glandular reddish bracts and bractlets, mostly deciduous before the flowers open; calyx narrowly obconic, glabrous, the lobes long, slender, glandular with large bright red stipitate glands, glabrous on the outer, slightly villose on the inner surface; stamens 5–10, usually 5–8; anthers deep rose-purple; styles 4 or 5, surrounded at base by a narrow ring of pale pubescence. **Fruit** ripening early in September and soon falling, on stout glabrous pedicels, in large many-fruited drooping clusters, short-oblong to slightly ovoid, rounded at the ends, bright cherry-red, lustrous, pruinose, marked by few large dark dots, $\frac{5}{8}'$–$\frac{3}{4}'$ long, and about $\frac{1}{2}'$ in diame-

ter; calyx only slightly enlarged, the lobes erect and incurved, coarsely serrate, dark red on the upper side below the middle, their tips deciduous from the ripe fruit; flesh thick, pale yellow, juicy; nutlets 4 or 5, narrow at the ends, irregularly ridged often with a high broad ridge, and sometimes grooved on the back, about $\frac{1}{4}'$ long.

A tree, occasionally 20° high, with a trunk a foot in diameter, ascending branches forming a narrow open head, and stout glabrous branchlets bright reddish brown and rather lus-

Fig. 455

trous during their first season, becoming light gray slightly tinged with red in their second year, and armed with stout straight or slightly curved spines $1'$–$1\frac{1}{2}'$ long; or occasionally shrubby, with a short trunk divided near the ground into several spreading stems.

Distribution. Rich moist ground, Stratford, Fairfield County (*E. H. Eames*), and Ansonia, New Haven County, Connecticut (*E. B. Harger*).

104. Cratægus sertata Sarg.

Leaves oblong-ovate, acuminate, rounded, truncate, subcordate or rarely cuneate at the broad base, finely and often doubly serrate with straight gland-tipped teeth, and deeply divided into 5 or 6 pairs of wide acuminate lobes, when they unfold coated above with short pale hairs and villose below on the midrib and veins, about half grown and villose when the flowers open during the first half of May, and at maturity membranaceous, dark yellow-green and scabrate on the upper surface, pale yellow-green and glabrous on the lower surface, $2\frac{1}{2}'$–$3'$ long, and $1\frac{1}{2}'$–$2'$ wide, with a thin yellow midrib, and slender primary veins arching obliquely to the point of the lobes; petioles slender, slightly grooved, villose early in the season, ultimately glabrous, sparingly glandular, $1\frac{1}{2}'$–$3'$ in length; leaves at the end of vigorous shoots broad-ovate, rounded or slightly cordate at base, often $3'$ long and $2\frac{1}{2}'$ wide. **Flowers** $\frac{3}{4}'$–$1'$ in diameter, on slender pedicels, in broad 10–15-flowered densely villose corymbs, with linear to linear-obovate glandular large and conspicuous caducous bracts and bractlets; calyx-tube broadly obconic, glabrous above, villose below, the lobes abruptly narrowed from the base, broad, acuminate, tipped with small red glands, coarsely glandular-serrate, glabrate on the outer surface, pubescent on the inner surface; stamens 5–10, usually 5; anthers pale rose color; styles 3–5, surrounded at base by tufts of pale hairs. **Fruit** ripening about the middle of September and soon falling, on slender villose or pubescent pedicels, in drooping many-fruited clusters, subglobose to slightly obovoid, rounded at the ends, bright red and lustrous, becoming darker or crimson when fully ripe, marked by occasional large pale dots, about $\frac{1}{2}'$ long and wide; calyx prominent, with enlarged mostly erect incurved serrate lobes; flesh thin, yellow, aromatic, pleasantly

acid; nutlets 3–5, usually 4, thin, narrow and acute at the ends, slightly ridged on the back with a wide or narrow ridge, $\frac{3}{8}'$ long.

A tree, 10°–20° high, with a trunk 6′–8′ in diameter and often 4°–5° long, covered with close dark gray bark separating into long narrow thin plate-like scales, stout spreading branches forming a handsome open head, and slender nearly straight branchlets thickly coated when they first appear with matted pale hairs, light brown and lustrous at the end

Fig. 456

of their first season, and dark gray-brown the following year, and unarmed or armed with stout nearly straight or curved spines 1′–$2\frac{1}{2}'$ long.

Distribution. Open woods and pastures in rich moist soil; northeastern Illinois (Mokena, Will County, Glenellyn, Dupage County, Barrington, Glendon Park, Cook County, Highland Park, Lake Zurich, Lake County); Fox Point, Milwaukee County, Wisconsin.

X. DILATATÆ.

CONSPECTUS OF THE ARBORESCENT SPECIES.

Flowers in broad 6–12-flowered corymbs.

Leaves broad-ovate; fruit bright scarlet. **105. C. dilatata** (A).

Leaves nearly orbicular to oval; fruit dull red blotched with green, or orange-red. **106. C. suborbiculata** (A).

Leaves ovate to slightly obovate; fruit crimson, pruinose. **107. C. hudsonica** (A).

Flowers in very compact 5–7-flowered corymbs; leaves broad-ovate; fruit usually broader than high, much flattened at the ends, dark crimson, very lustrous. **108. C. coccinioides** (A).

105. Cratægus dilatata Sarg.

Leaves broad-ovate, acute, truncate, cordate or slightly rounded at the broad base, coarsely and generally doubly and irregularly serrate above with straight teeth tipped with large dark glands, unequally lobed usually with 2 or 3 pairs of acute or acuminate lateral lobes, about one third grown when the flowers open at the end of May, and then light yellow-green, conspicuously plicate, roughened on the upper surface with short stiff white hairs and glabrous on the lower surface, and at maturity smooth and glabrous, dark green above, pale below, 2′–$2\frac{1}{2}'$ long, and almost as wide as long, with a slender midrib and 4 or 5 pairs of thin primary veins; petioles slender, somewhat glandular, at first villose, soon glabrous, often dark red toward the base after midsummer, 1′–2′ in length; leaves at

the end of vigorous shoots often 4′–5′ long, and frequently rather broader than long. **Flowers** 1′–1½′ in diameter, on slender elongated hairy pedicels, in broad, loose, usually 8–12-flowered slightly villose corymbs, with lanceolate bracts and bractlets glandular like the inner bud-scales with dark red glands; calyx-tube broadly obconic, covered toward the base with matted pale hairs, nearly glabrous above, the lobes broad, acuminate, coarsely glandular with large scattered red glands, glabrous on the outer surface and generally slightly villose on the inner surface; stamens 20; anthers large, rose color; styles usually 5, surrounded at base by small tufts of white hairs. **Fruit** ripening and falling early in September, on slender pedicels, in many-fruited drooping clusters, subglobose, bright scarlet, marked by numerous small dark dots, about ¾′ in diameter; the calyx much enlarged, with

Fig. 457

spreading coarsely serrate lobes bright red on the upper side toward the base; flesh thin, sweet and yellow; nutlets 5, thin, rounded and prominently ridged on the back, about ¼′ long.

A tree, occasionally 20° high, with a tall straight trunk, covered with light gray-brown scaly bark, branches spreading into a wide round-topped symmetrical head, and short glabrous slightly zigzag branchlets armed with few stout straight light brown shining spines 1′–2′ long.

Distribution. Eastern Massachusetts, coast of Rhode Island, western Vermont, in the neighborhood of Albany, New York, and near Montreal, Province of Quebec.

106. Cratægus suborbiculata Sarg.

Leaves nearly orbicular to oval or rarely to oblong, short-pointed at apex, broad and rounded or broad-cuneate at the entire base, sharply doubly serrate above with slender straight or incurved glandular teeth, and often divided above the middle into 3 or 4 pairs of short acute lobes, when they unfold pale yellow-green and somewhat villose on the upper surface toward the base and below in the axils of the principal veins, about a third grown when the flowers open during the first week of June, and at maturity thin and firm in texture, dull dark green above, paler below, usually about 1½′ long and broad, with a slender midrib and 4 or 5 pairs of thin primary veins; petioles slender, slightly glandular, more or less winged above, ⅜′–1′ in length; leaves at the end of vigorous shoots nearly orbicular to oval, more coarsely serrate and more deeply lobed, and frequently 3′ long and wide, their petioles often broadly winged and conspicuously glandular. **Flowers** ¾′ in diameter, on short stout pedicels, in compact 6–12-flowered glabrous corymbs; calyx broadly obconic, the lobes gradually narrowed from a broad base, long, acuminate, entire or occasionally

obscurely denticulate; stamens 20; anthers small, rose color; styles 5, surrounded at base by a broad ring of hoary tomentum. **Fruit** falling in October without becoming mellow, on short rigid pedicels, in few-fruited erect clusters, subglobose, often rather longer than broad, about $\frac{5}{8}'$ in diameter, dull red more or less blotched with green, or often wholly green on one face, or scarlet in one form; calyx enlarged, prominent, with a broad deep

Fig. 458

cavity and nearly entire wide-spreading lobes; flesh yellow, thin, dry and hard; nutlets 5, broad and thick, narrow and rounded at the ends, obscurely and unequally grooved on the back, about $\frac{1}{4}'$ long.

A tree, rarely more than 15°–20° high, with a well-developed trunk 5′–6′ in diameter, stout spreading branches forming a broad low flat-topped head, and stout branchlets orange-brown in their first season, becoming dark gray-brown the following year, and armed with thick straight or slightly curved bright chestnut-brown shining spines 1′–2′ in length.

Distribution. Low limestone ridges opposite Lachine near the south bank of the St. Lawrence River, and on the Island of Montreal, Province of Quebec; near Cornwall, Ontario.

107. Cratægus hudsonica Sarg.

Leaves ovate or slightly obovate, acute, gradually and abruptly narrowed and mostly concave-cuneate at the entire base, sharply and often doubly serrate above with straight or incurved glandular teeth, and frequently slightly divided above the middle into short acute lobes, nearly fully grown when the flowers open at the end of May, and then thin, light yellow-green, smooth and glabrous above with the exception of a few short white scattered hairs on the midrib, and pale and glabrous below, and at maturity thin and firm in texture, glabrous, 2′–$2\frac{1}{2}'$ long, and $1\frac{1}{2}'$–$1\frac{3}{4}'$ wide, with a slender yellow midrib, and 5 or 6 pairs of thin primary veins extending obliquely to the point of the lobes; petioles slender, wing-margined above, glandular, at first slightly hairy, becoming glabrous and rose color toward the base, $\frac{3}{4}'$–1′ in length; leaves at the end of vigorous shoots broad-ovate to suborbicular, full and rounded or broad-cuneate at the wide base, deeply divided into broad lateral lobes, and 2′–3′ long and wide. **Flowers** about $\frac{3}{4}'$ in diameter, on long slender pedicels, in broad usually 10–12-flowered glabrous corymbs; calyx-tube narrowly obconic, glabrous, the lobes gradually narrowed from a broad base, acuminate, glandular-serrate often only below the middle, glabrous on the outer surface, slightly hairy on the inner surface; stamens 20; anthers rose color; styles 3–5. **Fruit** ripening early in September, in

few-fruited drooping clusters, subglobose, crimson, pruinose, marked by numerous pale dots, about $\frac{5}{8}'$ in diameter; calyx enlarged, with a deep broad cavity, and closely appressed serrate lobes villose on the upper side; flesh thick, yellow, dry and mealy; nutlets 3–5, rounded at base and narrowed and rounded at apex, rounded and sometimes ridged on the back with a high rounded ridge, about $\frac{5}{16}'$ long.

Fig. 459

A tree, sometimes 20° high, with a tall trunk 8′–10′ in diameter, covered with pale scaly bark, heavy ascending and spreading branches forming a broad open head, and stout ascending glabrous branchlets dark orange color when they first appear and light orange-brown and lustrous during their first winter, and armed with numerous slender straight or slightly curved bright red-brown shining spines $1\frac{1}{2}'$–$2'$ long; sometimes a broad bush, with numerous stout spreading stems.

Distribution. Rolling hills in the valley of the Hudson River, near Albany, Albany County, New York.

108. Cratægus coccinioides Ashe.

Leaves broad-ovate, acute, full and rounded or truncate at base, sharply and often doubly serrate with straight glandular teeth, and divided above the middle into short acute lobes, as they unfold conspicuously plicate, very lustrous, yellow-green, and villose on the lower side of the midrib with a few short pale hairs usually persistent during the season, about half grown when the flowers open early in May, and at maturity thin and firm in texture, rather rigid, dull dark green and smooth on the upper surface, pale on the lower surface, $2\frac{1}{2}'$–$3'$ long, and $2'$–$2\frac{1}{2}'$ wide, with a thin pale yellow midrib deeply impressed above and often bright red toward the base after midsummer, and slender primary veins arching to the point of the lobes; turning late in October gradually bright orange and scarlet; petioles glandular on the upper side with minute-stalked dark red glands, at first villose, soon glabrous, often bright red or pink toward the base, $\frac{3}{4}'$–$1'$ in length; leaves at the end of vigorous shoots more or less cordate at base and usually $3\frac{1}{2}'$–$4'$ long and wide. **Flowers** $\frac{3}{4}'$ in diameter, in very compact 5–7-flowered glabrous or slightly villose corymbs, with coarsely serrate oblong-obovate acute bracts and bractlets, conspicuously glandular with large bright red glands; calyx-tube broadly obconic, glabrous, the lobes gradually narrowed from a broad base, acute and coarsely glandular-serrate; stamens 20; anthers large, deep rose color; styles 5, surrounded at base by a ring of pale tomentum. **Fruit** ripening early in October and falling gradually during a month or six weeks, on stout pedicels, in few-fruited compact erect clusters, subglobose, much flattened at the ends, often obscurely

angled, dark crimson, very lustrous, marked by numerous large pale dots, $\frac{3}{4}'$ long, and $\frac{7}{8}'$ wide; calyx much enlarged and conspicuous, with spreading or erect lobes bright red on the upper side near the base; flesh thick, firm, subacid, more or less deeply tinged with red; nutlets 5, comparatively small, light-colored, narrow at the ends, acute at apex, rounded at base, rounded and slightly ridged on the back, about $\frac{1}{3}'$ long.

Fig. 460

A tree, sometimes 20° high, with a stem 8′–10′ in diameter, covered with dark brown scaly bark, stout spreading light gray branches forming a broad handsome head, and stout nearly straight glabrous bright chestnut-brown very lustrous branchlets armed with thick dark reddish purple shining spines $1\frac{1}{2}'$–2′ long.

Distribution. Dry woods in the neighborhood of St. Louis, to southwestern Missouri and to Farmington, Washington County, Arkansas, in eastern Kansas.

XI. ROTUNDIFOLIÆ.

Coccineæ Sarg.

CONSPECTUS OF THE ARBORESCENT SPECIES.

Stamens 10; leaves coriaceous.

Leaves elliptic or obovate; fruit subglobose, dark crimson; anthers pale yellow. 109. **C. rotundifolia** (A).

Leaves elliptic or ovate; fruit short-oblong to oblong-obovoid, bright carmine-red; anthers rose color. 110. **C. Jonesæ** (A).

Stamens 20; leaves subcoriaceous, rhombic to oblong-obovate; fruit short-oblong to subglobose, dark dull red or rusty orange-red; anthers pale yellow. 111. **C. Margaretta** (A, C).

109. Cratægus rotundifolia Moen.

Cratægus coccinea var. *rotundifolia* Sarg.

Leaves elliptic or obovate, acute or acuminate, gradually narrowed from above the middle to the cuneate entire base, finely and often doubly serrate above with incurved or straight teeth tipped with minute dark glands, and divided above the middle into several short acute lateral lobes, about half grown when the flowers open at the end of May, and then thin, light yellow-green and glabrous, and at maturity coriaceous, dark green, smooth and lustrous on the upper surface, paler on the lower surface, $1\frac{1}{2}'$–2′ long, and 1′–$1\frac{1}{2}'$ wide,

with a thin midrib, and 4 or 5 pairs of primary veins extending to the point of the lobes; petioles slender, glandular, slightly winged at apex, glabrous, often dark red toward the base, ¾′–1′ in length; leaves at the end of vigorous shoots oblong-ovate, oval or often nearly orbicular, more deeply lobed, and frequently 2½′–3′ long and wide. **Flowers** ½′–¾′ in diameter, on slender pedicels, in broad loose many-flowered glabrous corymbs; calyx-tube

Fig. 461

broadly obconic, glabrous, the lobes gradually narrowed from a broad base, acute, coarsely glandular-serrate, glabrous, often bright red toward the apex; stamens 10; anthers small, pale yellow; styles 3 or 4. **Fruit** ripening and falling late in October, on short stout pedicels, in drooping many-fruited glabrous clusters, subglobose but occasionally rather longer than broad, dark crimson, marked by scattered dark dots, about ½′ in diameter; calyx enlarged, conspicuous, the lobes bright red on the upper side toward the base, wide-spreading or erect; flesh thin, yellow, dry and sweet; nutlets 3 or 4, rounded at the ends, about ¼′ long.

A bushy tree, occasionally 20° high, with a short trunk 8′–10′ in diameter, covered with dark red-brown scaly bark, stout ascending branches forming a broad round-topped symmetrical head, and slender glabrous branchlets light green when they first appear, bright red-brown and lustrous during their first year, and ultimately ashy gray, and armed with many stout straight or slightly curved chestnut-brown shining spines 1′–1½′ long.

Distribution. Nova Scotia, southern Quebec and Ontario to Manitoba and Saskatchewan (Saskatoon), and southward through New England, eastern and northern New York, the southern peninsula of Michigan and northern Indiana; in Pennsylvania (Lackawanna, Bucks, Northampton and Blair Counties); common in the New England coast region; a form (var. *pubera* Sarg.) with young leaves covered above with soft pale hairs and pubescent on the under side of the midrib and veins and villose petioles, flowers with a pubescent calyx-tube, in villose corymbs, becoming pilose when the fruit ripens, and young branchlets covered with long matted pale hairs, ranges from Newfoundland to the shores of Lake St. John, Province of Quebec, northern Ontario, Winnepeg and Manitoba, and southward through the maritime provinces of Canada, New England to southern Connecticut, northern and western New York (near Buffalo, Erie County), the northern peninsula of Michigan, northeastern Wisconsin : in central Minnesota (St. Cloud, Stearns County); common northward.

110. Cratægus Jonesæ Sarg.

Leaves elliptic to ovate, acute, gradually narrowed or broad-cuneate at the entire base, coarsely doubly serrate above with spreading or incurved teeth tipped with decidu-

ous dark red glands, and usually divided above the middle into 2 or 3 pairs of short acute or acuminate lobes, more than half grown when the flowers open during the first week of June, and then membranaceous and coated with soft pale hairs most abundant on the under side of the midrib and principal veins, and at maturity thick and coriaceous, dark green and lustrous on the upper surface, pale and puberulous on the lower surface, 3′–4′ long and 2′–3′ wide, with a stout midrib, 4–6 pairs of primary veins and conspicuous secondary veinlets; petioles stout, more or less winged toward the apex, villose, ultimately glabrous, tinged with red below the middle, $1\frac{1}{2}$′–2′ in length, after midsummer often twisted at base, bringing the lower surface of the leaf to the light; leaves at the end of vigorous shoots usually more coarsely serrate and much more deeply lobed, with broadly winged petioles, and falcate coarsely glandular-serrate stipules sometimes 1′ in length. **Flowers** 1′ in diameter, on long slender pedicels, in broad loose lax many-flowered tomentose corymbs; calyx-

Fig. 462

tube narrowly obconic, tomentose, the lobes abruptly narrowed from a broad base, long, acute, entire, villose; stamens 10; anthers large, rose color; styles 2, or generally 3, surrounded at base by a narrow ring of pale tomentum. **Fruit** ripening usually early in October, on slender elongated pedicels, in broad many-fruited drooping glabrous or puberulous clusters, short-oblong to oblong-obovoid, rounded at the ends, bright carmine-red, marked by occasional large dots, $\frac{3}{4}$′–1′ long, and $\frac{3}{4}$′ in diameter; calyx conspicuous, with enlarged and elongated closely appressed lobes; flesh thick, yellow, sweet and mealy; nutlets 3 or rarely 2, thick, narrowed and acute at base, full and broad at apex, rounded and ridged on the back with a high broad ridge, about $\frac{7}{16}$′ long.

A tree, sometimes 20° high, with a tall trunk often a foot in diameter, covered with dark brown scaly bark, ascending or spreading branches forming a broad open irregular head, and stout branchlets tomentose early in the season, becoming orange-brown, glabrous and very lustrous during their first summer, and light gray the following year, and armed with stout straight or curved chestnut-brown shining spines 2′–3′ long and usually pointed toward the base of the branch.

Distribution. Rocky shores of sounds and bays; coast of Maine, Islesboro and Belfast Bay to the island of Mount Desert (Waldo and Hancock Counties); in hedges, near Fredericton, York County, New Brunswick; Rivière du Loup, Kamouraska County, Province of Quebec (*Brother Victorin*).

111. Cratægus Margaretta Ashe.

Leaves broad-rhombic, oblong-obovate or rarely ovate, acute or rounded at apex, gradually narrowed and usually entire below, coarsely often doubly crenately-serrate

above with usually glandless teeth, and divided above the middle or frequently only at apex into short broad rounded or acute lobes; when the flowers open in May thin and roughened above by short pale hairs and glabrous below, and at maturity firm and rather leathery in texture, or subcoriaceous, glabrous, smooth, dark green and somewhat lustrous on the upper surface, pale on the lower surface, 1′–1¼′ long, and 1′ wide, with a yellow midrib, and 3–5 pairs of primary veins extending obliquely to the point of the lobes; petioles slender, often slightly winged toward the apex, glandular at first with minute dark red caducous glands, ½′–1′ in length; leaves at the end of vigorous shoots broad-ovate or semi-orbicular, usually more deeply and more generally lobed, often 3′ long and 2′–3′ wide. **Flowers** about ¾′ in diameter, on long slender pedicels, in 3–12-flowered thin-branched slightly villose corymbs; calyx-tube narrowly obconic, slightly villose toward the base, or glabrous, the lobes gradually narrowed from below, acuminate or short-pointed at apex, finely and irregularly glandular-serrate, glabrous or villose on the inner surface; stamens

Fig. 463

usually 20; anthers small, light yellow; styles 2 or 3, surrounded at the base by a narrow ring of pale tomentum, and villose below the middle with occasional long spreading hairs. **Fruit** ripening and falling at the end of September, in few-fruited drooping clusters, short-oblong, rounded at the ends, or subglobose and flattened at the ends, dull dark red or rusty orange-red or rarely yellow, marked by occasional dark dots, and about ½′ long; calyx only slightly enlarged, the lobes spreading or erect and frequently deciduous before the fruit ripens; flesh thin, yellow, dry and mealy; nutlets 2 or 3, broad and rounded at base, acute at apex, conspicuously grooved and ridged on the back with a broad rounded ridge, about ¼′ long.

A tree, occasionally 25° high, with a straight trunk 4′–6′ in diameter, covered with thin dark gray-brown bark, small rather erect branches forming a narrow open head, and slender branchlets, orange-green, glabrous or sometimes pubescent when they first appear, becoming bright chestnut-brown and lustrous, and ashy gray or gray tinged with red during their second year, and armed with thin straight or slightly curved bright chestnut-brown spines ¾′–1½′ long.

Distribution. Central Iowa (Steamboat Rock, Harden County, Cedar Rapids, Linn County), southward to Missouri (Hannibal, Marion County, Webster, St. Louis County to the neighborhood of Springfield, Greene County), and eastward to northeastern Illinois (Downers Grove, Dupage County); through north central Indiana to southern Michigan (Kalamazoo and Ingham Counties); through central and southern Ohio to the southeastern part of the state (Washington County); southeastern Ontario (London and Oakwood); in central Tennessee (West Nashville, Davidson County).

XII. INTRICATÆ.

CONSPECTUS OF THE ARBORESCENT SPECIES.

Stamens 10; leaves broad-ovate to oval.

Fruit depressed-globose, yellow-green flushed with russet-red; anthers pale yellow; calyx-lobes eglandular. 112. **C. Boyntonii** (A, C).

Fruit subglobose, red or russet-red; anthers pale rose color; calyx-lobes glandular with stalked glands. 113. **C. Buckleyi** (A).

Stamens 20.

Leaves oval to ovate or oblong-obovate; fruit short-oblong, dull red, often with a bright russet face; stamens usually 5–15; anthers small, pale yellow. 114. **C. venusta** (C).

Leaves oblong-ovate to elliptic or ovate; fruit subglobose to short-oblong, yellow or orange-yellow, more or less flushed with red; anthers large, purple. 115. **C. Sargentii** (C).

112. Cratægus Boyntonii Beadl.

Leaves broad-ovate to oval, acute, rounded or cuneate at the entire glandular base, sharply and often doubly serrate above with glandular teeth, and frequently divided into 2 or 3 pairs of short broad acute lateral lobes, when they unfold deep bronze-red, slightly

Fig. 464

glandular and viscid, nearly fully grown when the flowers open early in May, and then membranaceous and glabrous or occasionaly slightly pilose, and at maturity subcoriaceous, glabrous, yellow-green on the upper surface, pale on the lower surface, 1′–2½′ long, and 1′–2′ wide, with a thin pale yellow midrib and 4–7 pairs of slender veins; petioles stout, glandular often to the base with bright red glands, slightly winged above, usually about ½′ in length; leaves at the end of vigorous shoots often as broad as long, truncate or cordate at base, and more coarsely dentate and more deeply lobed. **Flowers** about ¾′ in diameter, on short slender pedicels, in compact 4–10-flowered compound corymbs; calyx-tube broadly obconic, the lobes abruptly narrowed from a broad base, acute or rounded at apex, entire or obscurely and irregularly glandular-serrate above the middle; stamens 10; anthers large, pale yellow; styles 3–5, surrounded at base by a broad thick ring of hoary tomentum. **Fruit** ripening and falling early in October, on short stout pedicels, in few-fruited erect clusters, depressed-globose, more or less angled, yellow-green flushed with russet-red, marked with small dark dots, usually about ½′ in diameter; calyx prominent, the large spreading lobes

often deciduous before the fruit ripens; nutlets 3–5, acute or acuminate at apex, rounded at the narrow base, about $\frac{1}{4}'$ long.

A tree, occasionally 20° high, with a tall straight trunk 6′–8′ in diameter, sometimes armed with long gray compound spines, stout ascending branches forming a narrow open irregular or occasionally a round-topped head, and glabrous branchlets furnished with many thin nearly straight light chestnut-brown spines $1\frac{1}{2}'$–2′ long; or more often a shrub, with numerous stems.

Distribution. Banks of streams, the borders of fields and upland woods in the southern Appalachian foothill region from southern Virginia to northern Georgia; in northern Alabama, southeastern Kentucky, and eastern Tennessee; sometimes ascending to altitudes of 3000° above the sea.

113. Cratægus Buckleyi Beadl.

Leaves broad-ovate or oval, acute, rounded or subcordate or narrowed and concave-cuneate at the entire base, coarsely often doubly serrate above with straight glandular teeth, and more or less incisely lobed with acuminate lateral lobes, more than half grown

Fig. 465

when the flowers open about the middle of May and then pale green and glabrous with the exception of a few caducous hairs on the upper side of the base of the midrib, and at maturity dark green above, paler below, $1\frac{1}{2}'$–2′ long, and $1\frac{1}{2}'$–2′ wide; petioles stout, conspicuously glandular above the base, wing-margined at the apex, glabrous, $\frac{1}{2}'$–$\frac{3}{4}'$ in length. **Flowers** about $\frac{3}{4}'$ in diameter, on slender glabrous pedicels, in compact 3–7-flowered simple corymbs, with conspicuously glandular bracts and bractlets; calyx-tube broadly obconic, glabrous, the lobes broad, acuminate, laciniately cut toward the apex, and glandular with stipitate glands; stamens 10; anthers pale rose color; styles 3–5, surrounded at base by tufts of pale hairs. **Fruit** ripening late in September or in October, subglobose, usually angled, red or russet-red, about $\frac{1}{2}'$ in diameter; calyx little enlarged, with spreading or reflexed lobes; flesh thin, dry and mealy; nutlets 3–5, broad and rounded at base, rounded at the slightly narrowed apex, prominently ridged on the back, with a broad grooved ridge, about $\frac{5}{16}'$ long.

A tree, often 25° high, with a trunk 4′–7′ in diameter and sometimes 10°–12° long, covered with gray or often dark brown scaly bark, stout spreading or ascending branches, and thick glabrous red-brown branchlets armed with thin straight shining spines $\frac{1}{2}'$ long, becoming much longer and branched on the trunk and large branches.

Distribution. Southwestern Virginia, through western North Carolina to eastern Tennessee; usually at altitudes between 2000° and 3000°; common on wooded slopes with Oaks, Hickories, and Pines.

114. Cratægus venusta Beadl.

Leaves oval to ovate or occasionally to oblong-ovate, acute, gradually or abruptly narrowed and cuneate or rounded at the entire base, finely serrate above with usually incurved glandular teeth, and frequently slightly and irregularly divided above the middle into 1–3 pairs of short broad acute lobes, when they unfold dark bronze color, with a few scattered pale caducous hairs on the upper surface, about half grown when the flowers open from the 20th to the end of April, and then yellow-green, smooth and glabrous, and at maturity dark dull green above, pale below, $2\frac{1}{2}'$ long, and $1\frac{1}{2}'$ wide, with a stout midrib and 4–7 pairs of thin primary veins; late in the autumn turning, especially those on leading shoots deep orange or scarlet; petioles stout, glandular, more or less winged above, $\frac{1}{2}'$–$\frac{3}{4}'$ in length; leaves at the end of vigorous shoots generally broad-ovate, rounded at base, deeply lobed with broad lobes, and often $3\frac{1}{2}'$ long and $3'$ wide. **Flowers** $1'$ in diameter, on short pedicels, in 4–9-flowered compact corymbs, their bracts and bractlets like the inner bud-

Fig. 466

scales coarsely glandular-serrate and bright red before falling; calyx-tube broadly obconic, the lobes gradually narrowed from a broad base, acute, coarsely glandular-serrate often only below the middle; stamens 15–20, usually 15–17; anthers small, pale yellow; styles 3–5, surrounded at the base by a ring of pale hairs. **Fruit** ripening and falling from the 1st to the middle of October, on stout pedicels often $1'$ long, in few-fruited clusters, short-oblong, rounded at the ends, dull red, often with a bright russet face, and marked by occasional large dark dots; calyx prominent, with a long tube, and spreading lobes often deciduous before the fruit ripens; flesh thick, yellow, dry and mealy; nutlets 3–5, narrow and acute at base, broad, about $\frac{1}{4}'$ long.

A bushy tree, often 25° high, with a short trunk a foot in diameter, furnished like the large branches with innumerable stout much-branched spines frequently $6'$ long, and slender nearly straight glabrous dark chestnut-brown branchlets, armed with many stout straight or slightly curved dark chestnut-brown shining spines frequently pointing toward the base of the branch, and $1\frac{1}{2}'$–$2\frac{1}{2}'$ long.

Distribution. Open Oak and Hickory-woods on the dry slopes of Red Mountain in the southern part of the city of Birmingham, Jefferson County, Alabama.

115. Cratægus Sargentii Beadl.

Leaves oblong-ovate to elliptic or rarely to ovate, acute or acuminate at apex, gradually or abruptly cuneate or rounded at the nearly entire base, irregularly doubly serrate above with straight or incurved glandular teeth, and usually irregularly divided into 3 or 4 pairs

of short broad acute or acuminate lobes, nearly fully grown when the flowers open late in April, and then subcoriaceous, pale yellow-green, and villose on the midrib with scattered pale caducous hairs, and at maturity lustrous, dark yellow-green above, pale below, 2′–3′ long, and 1½′–2′ wide, with a thin midrib, 5–7 pairs of thin light yellow veins and conspicuous reticulate veinlets; turning in the autumn bright yellow and red; petioles slender, glandular, more or less broadly winged toward the apex, ½′–¾′ in length; leaves at the end of vigorous shoots oblong-ovate, concave-cuneate at base, often 3′ long and 2′ wide, their petioles broadly wing-margined to below the middle. **Flowers** nearly 1′ in diameter, on long thin slightly villose pedicels, in 2–5 usually 3-flowered simple corymbs, with coarsely glandular-serrate bracts and bractlets; calyx-tube narrowly obconic, glabrous or slightly villose, the lobes foliaceous, acute, coarsely glandular-serrate above the middle; stamens 20; anthers large, dark rose color; styles 3–5, usually 4, surrounded at base by a narrow ring of pale hairs. **Fruit** ripening and falling about the middle of September, often only a single fruit maturing from a flower-cluster, subglobose to short-oblong, rounded at the

Fig. 467

ends, yellow or orange-yellow, generally more or less flushed with red, marked by occasional large dark dots, ½′–¾′ long; calyx prominent, with an elongated tube and closely appressed lobes; flesh yellow, thin and hard; nutlets 3–5, usually 4, about ¼′ long.

An intricately branched tree, rarely more than 20° high, with a tall trunk 6′–7′ in diameter, stout ascending branches forming a narrow or sometimes a round flat-topped head, and glabrous branchlets armed with thin straight or slightly curved dark chestnut-brown shining spines, ¾′–1½′ long; often a large shrub, with few or many stems.

Distribution. Rocky woods and bluffs in the foothill region of northwestern Georgia (cliffs of the Coosa River near Rome, Floyd County), southeastern Tennessee (near Chatanooga, Hamilton County, and Tracy City, Grundy County), and northeastern Alabama; very abundant in Alabama at Valley Head, De Kalb County, and on the low ridges extending southward to the neighborhood of Birmingham, Jefferson County.

XIII. PULCHERRIMÆ.

CONSPECTUS OF THE ARBORESCENT SPECIES.

Leaves oval to ovate or nearly orbicular, their lobes acute or rounded; fruit bright red. 116. **C. opima** (C).

Leaves ovate to oval or obovate, their lobes acute; fruit orange-red. 117. **C. robur** (C).

116. Cratægus opima Beadl.

Leaves oval to ovate or nearly orbicular, acute, gradually or abruptly narrowed and cuneate at the entire base, finely serrate above with incurved teeth, and usually divided above the middle into short acute, acuminate or rounded lobes, half grown when the flowers open the middle of April, and then glabrous with the exception of a few short caducous hairs on the midrib and veins, and at maturity light green on the upper surface, pale on the lower surface, $1\frac{1}{2}'$ long, and $1\frac{1}{4}'$ wide, with a slender midrib, and 5 or 6 pairs of arcuate primary veins spreading to the point of the lobes; petioles narrowly winged at the apex, usually about $\frac{3}{4}'$ in length; leaves at the end of vigorous shoots sometimes rounded or nearly truncate at base and $1\frac{1}{2}'$–$2\frac{1}{2}'$ long and broad. **Flowers** about $\frac{3}{4}'$ in diameter, on short slender pedicels, in compact few-flowered glabrous corymbs; calyx-tube broadly obconic, glabrous, the lobes gradually narrowed from a broad base, acute, entire or sparingly glandular-serrate, tipped with dark red glands, glabrous on the outer surface, puberulous on the inner surface; stamens 20; anthers dark rose color; styles 3–5, surrounded at base by a narrow ring of snowy white tomentum. **Fruit** ripening about the 1st of October and

Fig. 468

then remaining on the branches for several weeks, on short stout pedicels, in compact few-fruited erect or drooping clusters, subglobose, often rather longer than broad, bright red, about $\frac{1}{4}'$ in diameter; calyx prominent, with a well-developed tube, and much enlarged closely appressed lobes often deciduous with the tube before the fruit becomes entirely ripe; flesh thin, yellow, dry and mealy; nutlets 3–5, thin, $\frac{1}{3}'$ long.

A tree, 20°–25° high, with a tall, slender often spiny trunk covered with ashy gray bark nearly black at the base of old trees, spreading and ascending branches forming a rounded or oval usually open head, and thin nearly straight bright red-brown glabrous branchlets becoming gray tinged with red or brown in their second season, and armed with thin nearly straight bright chestnut-brown lustrous spines, $1'$–$1\frac{1}{2}'$ long.

Distribution. Open woods in clay soil in the neighborhood of Greenville, Butler County, Alabama; common near Tallahassee, Leon County, Florida.

117. Cratægus robur Beadl.

Leaves ovate, oval or obovate, acute or acuminate, entire or sparingly glandular below, finely serrate above with incurved glandular teeth, and incisely lobed above the middle with numerous short acute lobes, nearly fully grown when the flowers open at the end of March, and then membranaceous and dark yellow-green and lustrous, and at maturity

yellow-green, $1\frac{1}{2}'$–$2'$ long, and $1'$–$1\frac{1}{2}'$ wide, with a slender yellow midrib, and thin primary veins extending very obliquely to the point of the lobes; turning in the autumn orange, yellow, or brown; petioles slender, slightly wing-margined toward the apex, sparingly glandular, $\frac{1}{2}'$–$1'$ in length; leaves at the end of vigorous shoots broadly ovate, cuneate or nearly truncate at the wide base, deeply divided into broad lateral lobes, often $2'$–$3'$ long and broad, with a stout broadly winged petiole frequently $1'$ long. **Flowers** $1\frac{1}{8}'$–$1\frac{1}{4}'$ in diameter, on long slender pedicels, in 5–10-flowered glabrous corymbs, with large conspicuously glandular bracts and bractlets; calyx-tube narrowly obconic, glabrous, the lobes gradually narrowed from a broad base, glabrous, entire or sparingly serrate; stamens 20; anthers pale rose color; styles 3–5, surrounded at base by a narrow ring of pale hairs. **Fruit** ripening in September and October, on elongated, slender pedicels, in few-fruited drooping clusters, subglobose, orange-red, about $\frac{1}{2}'$ in diameter; calyx-lobes deciduous before the maturity of the fruit leaving a narrow ring round the shallow cavity; flesh thin and firm; nutlets 3–5, broad, rounded at the ends, barely grooved on the rounded back, $\frac{3}{16}'$ long and nearly as broad.

Fig. 469

A tree, 20°–25° high, with a trunk $4'$–$6'$ in diameter, covered with gray or brown scaly bark, spreading or ascending branches, and slender red-brown branchlets unarmed or armed with stout spines $\frac{3}{4}'$–$1'$ long; more often a large much-branched shrub, with one or more stems.

Distribution. Woods and borders of fields, northwestern Florida; common in the neighborhood of Tallahassee, Leon County.

XIV. BRACTEATÆ.

CONSPECTUS OF THE ARBORESCENT SPECIES.

Leaves oval to broad-obovate, subcoriaceous; corymbs many-flowered; stamens 10–20, usually 20; fruit bright red or orange-red. 118. **C. Harbisonii** (C).

Leaves broad-ovate or rarely obovate, thin; corymbs 3–10-flowered; stamens 20; fruit bright red. 119. **C. Ashei** (C)

118. Cratægus Harbisonii Beadl.

Leaves oval to broad-obovate, acute at apex, cuneate or rounded at the entire base, and coarsely serrate above with straight glandular teeth, when they unfold roughened above by stout, rigid pale hairs, and soft and pubescent below, nearly fully grown early in

May when the flowers open, and then thin, dark yellow-green above and pale below, and at maturity subcoriaceous; pale on the lower surface, 2′–2½′ long, and 1′–1½′ wide, with a stout midrib and primary veins deeply impressed on the upper side of the leaf, and conspicuous reticulate veinlets; petioles stout, villose, more or less winged above, ¼′–½′ in length; leaves at the end of vigorous shoots broad-ovate, cuneate and decurrent on their stouter petiole, 3′–4′ long, and 2½′–3′ wide, with lunate coarsely glandular-dentate stipules frequently ½′ long. **Flowers** ¾′ in diameter, in broad loose usually 10–12-flowered corymbs, with broad acute conspicuous glandular-serrate bracts and bractlets; calyx-tube broadly obconic, densely villose at the base and glabrous or pubescent above, the lobes elongated, gradually narrowed from a broad base, acute, bright green, more or less hairy, coarsely glandular-serrate, with large stipitate dark red glands; stamens 10–20, usually 20; anthers large, light yellow; styles 3–5. **Fruit** ripening and falling early in October, subglobose, often rather longer than broad, bright red or orange-red, marked by numerous large dark dots; calyx enlarged, with spreading glandular lobes often deciduous before the fruit ripens; flesh yellow, thick, dry and mealy; nutlets 3–5, narrowed at the ends, ¼′ long.

Fig. 470

A tree, sometimes 25° high, with a trunk 10′–12′ in diameter, covered with light gray or gray-brown bark, and often armed with straight or much-branched spines, wide-spreading light gray or reddish branches forming a rather open symmetrical head, and slender branchlets coated when they first appear with long spreading white hairs, pubescent or glabrous and light red-brown or orange-brown during their first season, becoming dark or light gray the following year, and furnished with numerous usually stout straight dark reddish brown shining spines 1½′–2′ long.

Distribution. Dry limestone hills and ridges; West Nashville, Davidson County, Tennessee; common.

119. Cratægus Ashei Beadl.

Leaves broad-ovate or occasionally obovate, acute and generally short-pointed at apex, gradually or abruptly narrowed and cuneate and usually entire at base, coarsely and occasionally doubly serrate above with straight or incurved teeth tipped with small dark glands, when they unfold roughened on the upper surface with short pale hairs and pubescent below, nearly fully grown and membranaceous when the flowers open early in May, and at maturity thin but firm in texture, pale and puberulous on the lower surface on the slender midrib and primary veins, about 2′ long and 1½′ wide; petioles stout, broadly winged above, glandular, pubescent early in the season but ultimately nearly glabrous, about ½′ in length;

leaves at the end of vigorous shoots usually broadly oval or nearly orbicular, rounded or short-pointed at apex, 2½′–3′ long, and 2′–2½′ wide. **Flowers** ¾′ in diameter, on slender hairy pedicels, in 3–10-flowered simple or compound corymbs, with broad conspicuous glandular bracts and bractlets; calyx-tube broadly obconic, thickly coated with long matted reflexed white hairs, the lobes broad, acute, nearly glabrous on the outer surface, villose on the inner surface, glandular with small stout stipitate glands; stamens 20; anthers small, yellow; styles 3–5, surrounded at base by a narrow ring of pale hairs. **Fruit** ripening and falling late in September or early in October, on stout villose or glabrous pedicels, in few-fruited clusters, subglobose or rather longer than broad, bright red, marked by large scattered dots, more or less villose toward the ends, about 1′ in diameter; calyx conspicuous, with elongated coarsely glandular-serrate, erect incurved or reflexed lobes; flesh thick and yellow; nutlets 3–5, thin, acute at the ends, ⅓′ long.

A tree, rarely more than 20° high, with a slender trunk covered with smooth light gray or red-brown bark becoming fissured and scaly on old individuals, stout ascending branches

Fig. 471

forming a pyramidal or oval head, and slender branchlets coated when they first appear with long pale matted reflexed hairs, soon becoming nearly glabrous, lustrous, orange-brown or reddish brown, and light gray or gray tinged with red during their second season, and armed with straight or slightly curved thin dark red-brown shining spines 1′–1½′ long.

Distribution. Abandoned fields, and woods, growing usually on clay soils; near Montgomery, Montgomery County, and Gallion, Hale County, Alabama.

XV. FLAVÆ.

CONSPECTUS OF THE ARBORESCENT SPECIES.

Stamens 20.
- Anthers pink or purple.
  - Corymbs usually 3–6-flowered.
    - Leaves elliptic to broad-ovate, yellow-green; fruit dark orange-brown. 120. **C. flava** (C).
    - Leaves ovate to obovate or orbicular, bright yellow-green; fruit obovoid, dark orange color with a red cheek. 121. **C. visenda** (C).
    - Leaves obovate or ovate, dark green; fruit subglobose to short-oblong, red or orange-red. 122. **C. ignava** (C).

Corymbs 1–5-flowered.
Leaves broad-obovate to nearly orbicular, bright green; fruit globose or depressed-globose, bright red. 123. **C. consanguinea.**
Leaves obovate, bright green; fruit ellipsoidal to short-oblong, orange-red; anthers pink. 124. **C. tristis.**
Anthers yellow (*doubtful in* 128, 133).
Leaves yellow-green.
Leaves 3-nerved.
Leaves obovate-cuneate, often 3-lobed at apex; fruit obovoid to subglobose, bright orange-red and lustrous; corymbs tomentose. 125. **C. floridana.**
Leaves obovate; fruit subglobose to short-oblong, dull brownish yellow; corymbs glabrous. 126. **C. lacrimata.**
Leaves with numerous primary veins.
Leaves thin.
Leaves scabrate above at maturity, obovate, rounded or abruptly short-pointed at apex; fruit subglobose to short-oblong, bright orange-red. 127. **C. Ravenelii** (C).
Leaves smooth above at maturity.
Leaves obovate to obovate-cuneiform; fruit subglobose, bright red. 128. **C. senta** (A).
Leaves obovate to oval or orbicular; fruit subglobose to ellipsoidal, orange-red or red and orange. 129. **C. annosa** (C).
Leaves subcoriaceous.
Flowers in 3–5-flowered corymbs.
Leaves obovate; fruit globose or depressed-globose, orange-yellow with a red cheek. 130. **C. panda** (C).
Leaves obovate to oblong-ovate, minutely serrate; fruit globose, red or yellow. 131. **C. integra** (C).
Flowers in 1 or 2-flowered corymbs; leaves spathulate; fruit obovoid, red. 132. **C. recurva** (C).
Leaves conspicuously blue-green, broad-ovate to orbicular; fruit subglobose to short-oblong, light red, puberulous at the ends. 133. **C. dispar** (C).
Stamens 10; anthers yellow; leaves broad-obovate to oval or rhombic, dark yellow-green; fruit subglobose, dull orange-red, often slightly villose at the ends. 134. **C. aprica** (C).

120. Cratægus flava Ait.

Leaves elliptic to broad-obovate, acute or rarely rounded at apex, gradually narrowed and cuneate at the glandular base, and coarsely doubly serrate above with broad straight or incurved teeth tipped with large dark red stipitate glands, when they unfold bronze color, villose above with short pale caducous hairs most abundant near the base of the midrib and pubescent below on the midrib and veins, about half grown when the flowers open from the 10th to the 20th of April, and at maturity membranaceous, yellow-green, usually about 2′ long and 1½′ wide, with a slender yellow midrib and 3 or 4 pairs of primary veins usually puberulous on the under side and only slightly impressed above; petioles slender, glandular, winged nearly to the base, generally more or less villose, after midsummer often light red on the lower side, and about ½′ in length; leaves at the end of vigorous shoots frequently 3′ long and 2′ wide, and sometimes broad-ovate, 3-lobed or divided into 2 or 3 pairs of lateral lobes, their petioles 1′–1½′ long, broadly winged and conspicuously glandular, and foliaceous lunate or elliptic coarsely glandular-serrate stipules. **Flowers** about ¾′ in diameter, on short slender pedicels, in few-flowered simple or compound slightly villose compact corymbs, with lanceolate acute coarsely glandular-serrate bracts and bractlets; calyx-tube broadly obconic, glabrous, the lobes wide, acute, usually laciniately divided, very glandular; stamens 20; anthers large, dark rose color. **Fruit** ripening early in October and soon falling, in few-fruited drooping clusters, short-oblong, full and rounded at the ends,

dark orange-brown, $\frac{1}{2}'$–$\frac{5}{8}'$ long, and $\frac{1}{3}'$–$\frac{1}{2}'$ in diameter; calyx prominent, with a long narrow tube, and enlarged closely appressed lobes often deciduous before the fruit ripens; flesh thick, orange color, dry and mealy; nutlets 5, gradually narrowed and rounded at the ends, ridged and deeply grooved on the back with a high narrow ridge, about $\frac{1}{2}'$ long.

Fig. 472

A tree, 15°–20° high, with a tall trunk 8′–10′ in diameter, covered with thin dark brown bark tinged with red and divided into narrow rounded ridges, stout ascending branches forming an open and somewhat irregular head sometimes 20° across, and slender slightly zigzag glabrous branchlets dark green deeply tinged with red when they first appear, becoming dull red-brown or orange-brown during their first season, darker the following year, and ultimately dark gray-brown, and armed with thin nearly straight bright chestnut-brown spines $\frac{3}{4}'$–$1\frac{1}{4}'$ long.

Distribution. Dry sandy soil on the sand hills of Summerville, near Augusta, Richmond County, Georgia, and at River Junction, Gadsden County, Florida.

121. Cratægus visenda Beadl.

Leaves ovate, obovate, or orbicular, short-pointed and acute or occasionally broad and rounded at apex, concave-cuneate and gradually narrowed at the mostly entire base, finely

Fig. 473

serrate above with rounded teeth, glandular with bright red glands, and divided above the middle into short acute lobes, nearly fully grown when the flowers open at the end of March, and then glabrous with the exception of a few short pale hairs on the two surfaces near the base of the midrib, and at maturity thin and firm in texture, bright yellow-green and lustrous above, pale below, glabrous, 1′–1½′ long, and ¾′–1′ wide, with a slender midrib, and thin primary veins extending very obliquely to the point of the lobes; turning yellow, orange, or brown in the autumn; petioles slender, broadly wing-margined above the middle, conspicuously glandular, sparingly villose early in the season, becoming nearly glabrous, ½′–¾′ in length. **Flowers** about ¾′ in diameter, on short villose pedicels, in simple 3–6-flowered corymbs; calyx-tube broadly obconic, hairy near the base with scattered pale hairs, glabrous above, the lobes broad, acuminate, glandular-serrate, glabrous on the outer, pilose on the inner surface; stamens 20; anthers pale purple; styles 3–5, surrounded at base by small tufts of white hairs. **Fruit** ripening and falling late in August and early in September, on stout pedicels, usually in 1 or 2-fruited clusters, obovoid, dark orange-colored, with a red cheek, ½′–⅝′ long, nearly ½′ in diameter; calyx enlarged, the lobes coarsely glandular-serrate, puberulous on the upper surface, closely appressed; flesh soft and yellow; nutlets 3–5, obtuse and rounded at the ends, rounded and slightly ridged on the back, about ⅜′ long.

A tree, sometimes 30° high, with a trunk 10′–12′ in diameter, covered with dark gray or brownish bark, crooked horizontal or ascending branches forming a broad irregular head, and stout often contorted branchlets villose when they first appear, soon glabrous, dull reddish brown to ashy gray, and armed with slender straight spines ½′–⅝′ long.

Distribution. Sandy soil near Bristol, Liberty County, Florida.

122. Cratægus ignava Beadl.

Leaves obovate to ovate, acute, gradually narrowed from near the middle to the concave-cuneate glandular base, sharply often doubly serrate above with glandular teeth, and usually divided toward the apex into short acute lobes, nearly fully grown when the flowers

Fig. 474

open at the end of April, and then membranaceous, glabrous with the exception of a few hairs on the midrib above and on the midrib and slender veins below, and at maturity subcoriaceous, bright green and lustrous on the upper surface, pale and still hairy on the lower surface, 1½′–2′ long, and 1′–1½′ wide; turning in the autumn yellow and brown sometimes flushed with red; petioles slender, wing-margined at the apex, glandular, ¼′–½′ in length. **Flowers** about ¾′ in diameter, on slender glabrous pedicels, in 3–6-flowered simple corymbs, with lanceolate conspicuously glandular reddish bracts and bractlets; calyx-tube broadly

obconic, glabrous, the lobes abruptly narrowed from the base, wide, glabrous, glandular with dark red stipitate glands, and often coarsely serrate above the middle; stamens 20; anthers large, dark rose color; styles 3–5, surrounded at base by a ring of pale hairs. **Fruit** ripening and falling at the end of September and early in October, on slender erect pedicels, in few-fruited clusters, subglobose to short-oblong, orange-red, marked by numerous pale dots, about $\frac{3}{8}'$ long; calyx enlarged and prominent, with spreading lobes often deciduous from the ripe fruit; flesh thick and soft; nutlets 3–5, rounded at the ends, prominently but irregularly ridged and grooved on the back, $\frac{1}{4}'$ long.

A tree, sometimes 10°–12° high, with a slender trunk covered with ashy gray fissured scaly bark often tinged with brown and frequently nearly black near the ground, stout ascending branches, and slender zigzag glabrous branchlets bright red-brown during their first season, becoming dark gray-brown, and armed with many very slender red-brown lustrous ultimately ashy gray spines $1'–1\frac{1}{2}'$ long.

Distribution. Northeastern Alabama; common on Lookout Mountain above Valley Head and at Collinsville, DeKalb County, and at Gadsden, Etowah County.

123. Cratægus consanguinea Beadl.

Leaves broad-obovate to nearly orbicular, occasionally oval or rhombic, acute and generally short-pointed at apex, gradually narrowed and concave-cuneate or sometimes rounded at the entire base, finely and often doubly serrate with glandular teeth, and frequently irregularly divided above the middle into short acute lobes, nearly fully grown when the flowers open at the end of March or early in April, and then very thin, blue-green, slightly villose, especially on the midrib and veins, and at maturity thin, bright green, glabrous with the exception of a few hairs on the under side of the slender midrib, and thin primary veins extending very obliquely toward the end of the leaf, about 1′ long, and $\frac{3}{4}'–\frac{7}{8}'$ wide; petioles slender, glandular, wing-margined above, villose early in the season, becoming glabrous, $\frac{1}{3}'–\frac{3}{4}'$ in length; leaves at the end of vigorous shoots often $1\frac{1}{2}'–2'$ long and wide. **Flowers** $\frac{3}{4}'$ in diameter, on long slender hairy pedicels, in simple 1–5-flowered corymbs, with oblanceolate acuminate bright red caducous bracts and bractlets; calyx-tube broadly obconic, sparingly hairy with long pale caducous hairs, the lobes gradually narrowed from a broad base, acute, glandular with minute bright red glands, glabrous; stamens 20; anthers small, deep rose color; styles 3–5, surrounded at base by a narrow ring of short pale hairs. **Fruit** ripening and falling about the middle of September, on slender glabrous pedicels, often only a single fruit in a cluster developing, globose to depressed-globose, bright red, marked by small dark dots, nearly $\frac{1}{2}'$ in diameter; calyx prominent, with en-

Fig. 475

larged appressed lobes; flesh thin, yellow, dry and mealy; nutlets 3–5, thick, narrowed and rounded at base, broad and rounded at apex, ridged on the back with a broad low rounded ridge, about $\frac{5}{16}'$ long.

A tree, often 20° high, with a tall trunk 6′–8′ in diameter, covered with nearly black deeply furrowed bark broken into short thick closely appressed scales, wide-spreading often pendulous branches forming a broad symmetrical handsome head, and slender slightly zigzag branchlets covered when they first appear with pale caducous hairs, soon becoming bright red-brown and lustrous, and dull reddish brown in their second season, and armed with short nearly straight gray or chestnut-brown spines $\frac{1}{3}'$–$\frac{3}{4}'$ long.

Distribution. Dry upland Oak-woods in middle Florida from the neighborhood of Tallahassee, Leon County to the Apalachicola River; common in the neighborhood of River Junction, Gadsden County, and at Aspalaga, Liberty County.

124. Cratægus tristis Beadl.

Leaves obovate, acute, acuminate, or rounded and often more or less undulate-lobed at the broad apex, gradually narrowed from above the middle and concave-cuneate at the glandular base, and serrate above with blunt glandular teeth, about half grown when the

Fig. 476

flowers open at the end of April, and then slightly pilose on the upper and villose on the lower surface on the thin midrib and in the axils of the slender veins extending obliquely to the point of the lobes, and at maturity thin and firm in texture, bright green and glabrous, $1\frac{1}{4}'$–$1\frac{1}{2}'$ long, and about $\frac{3}{4}'$ wide; turning in the autumn yellow, brown, and orange; petioles slender, wing-margined above, conspicuously glandular, slightly puberulous, $\frac{1}{2}'$–$\frac{3}{4}'$ in length; leaves at the end of vigorous shoots oblong-obovate, often deeply and irregularly divided into broad acute lateral lobes, and frequently $1\frac{1}{2}'$–$2'$ long and nearly as broad. **Flowers** $\frac{5}{8}'$–$\frac{3}{4}'$ in diameter, on slender villose pedicels, in simple 3–5-flowered corymbs, with rose-colored and conspicuously glandular bracts and bractlets; calyx-tube broadly obconic, hairy toward the base with long scattered pale hairs, the lobes gradually narrowed from a broad base, acuminate, glandular with large dark red glands, and entire or coarsely serrate above the middle; stamens 20; anthers pink; styles 3–5. **Fruit** ripening and falling late in August or early in September, ellipsoidal or short-oblong, orange-red, about $\frac{1}{2}'$ long, with soft flesh; calyx little enlarged, with recurved persistent lobes; nutlets 3–5, broad and rounded at base, gradually narrowed and acute at apex, rounded and ridged on the back with a broad low slightly grooved ridge, about $\frac{5}{16}'$ long.

A tree, sometimes 25° high, with a trunk 8′–10′ in diameter, covered with dark sometimes nearly black deeply furrowed bark, stout pendulous branches forming a broad

shapely handsome head, and slender branchlets hoary-tomentose when they first appear, bright red-brown and puberulous at the end of their first season, becoming dark gray-brown, and armed with few slender straight spines $1\frac{1}{4}'$–$1\frac{1}{2}'$ long; or often a large shrub.

Distribution. Slopes of low hills, northwestern Georgia; common in the neighborhood of Rome, Floyd County.

125. Cratægus floridana Sarg.

Leaves obovate-cuneate, frequently 3-lobed at apex with short rounded lobes, gradually narrowed and cuneate at the entire base, finely serrate above with straight or incurved teeth tipped with conspicuous ultimately dark persistent glands, 3-nerved with slender nerves, numerous thin secondary veins and reticulate veinlets, slightly villose above as they unfold, nearly fully grown when the flowers open about the middle of March, and then light yellow-green and glabrous with the exception of a few persistent hairs on the upper side of the nerves and in their axils, and at maturity thick and firm, dark green and lustrous

Fig. 477

on the upper surface, pale on the lower surface, $1'$–$1\frac{1}{2}'$ long, and about $\frac{1}{2}'$ wide; petioles slender, glandular, more or less winged toward the apex, tomentose, becoming pubescent or glabrous, usually about $\frac{1}{2}'$ in length; leaves at the end of vigorous shoots frequently $2'$ long, and sometimes divided by deep rounded sinuses into numerous narrow lateral lobes, their stipules lunate, foliaceous, pointed, coarsely glandular-serrate. **Flowers** about $\frac{5}{8}'$ in diameter, on slender tomentose pedicels, in few usually 1–3-flowered simple compact corymbs; calyx-tube broadly obconic, coated with long matted white hairs, the lobes narrow, acuminate, glandular with bright red stipitate glands, villose toward the base on the outer surface and on the inner surface; stamens 20; anthers small, pale yellow; styles 4 or 5, surrounded at the base by a broad ring of long shining white hairs. **Fruit** ripening from the middle to the end of August, on short stout pubescent pedicels, solitary or in 2 or 3-fruited drooping clusters, obovoid to short-oblong, usually about $\frac{3}{4}'$ long, bright orange-red, lustrous, marked by numerous pale dots; calyx prominent, with an elongated tube puberulous on the outer surface, and reflexed glandular-serrate lobes; flesh thin, yellow, dry and mealy; nutlets 4 or 5, acute at base, broad and rounded at apex, rounded and occasionally slightly ridged on the back, about $\frac{1}{2}'$ long.

A tree, rarely more than 15° high, with a long straight trunk $6'$–$8'$ in diameter, covered with thick nearly black deeply furrowed bark broken into short thick plate-like scales, small drooping branches forming a handsome symmetrical head, and slender conspicuously zigzag pendulous branchlets coated when they first appear with long pale matted hairs,

becoming during their first season dark red-brown and more or less villose, and dark brown the following year, and armed with thin straight spines $\frac{3}{4}'$–$1'$ long, or unarmed.

Distribution. Dry sandy soil of the Pine-barrens of northeastern Florida; abundant in the neighborhood of Jacksonville, Duval County.

126. Cratægus lacrimata Small.

Leaves obovate, rounded or acute and glandular-serrate at apex usually with incurved teeth, entire and glandular below, gradually narrowed from above the middle to the base, and 3-nerved with slender yellow nerves, numerous thin secondary veins and reticulate veinlets, when the flowers open early in April nearly fully grown, light yellow, glabrous, with the exception of small tufts of pale caducous hairs in the axils of the nerves below, and at maturity subcoriaceous, lustrous, $\frac{1}{4}'$–$\frac{3}{4}'$ long, and about $\frac{1}{3}'$ wide; petioles slender, wing-margined toward the apex, dark orange-brown, at first puberulous, soon becoming glabrous, $\frac{1}{4}'$–$\frac{1}{2}'$ in length. **Flowers** about $\frac{2}{3}'$ in diameter, on short stout glabrous pedicels, in 3–5-flowered simple corymbs, with long linear entire caducous bracts and bractlets turning

Fig. 478

red in fading; calyx-tube broadly obconic, glabrous, the lobes gradually narrowed from a broad base, acuminate, entire, tipped with large dark glands; stamens 20; anthers large, light yellow; styles usually 3, surrounded at base by a narrow ring of pale hairs. **Fruit** ripening toward the end of August, on slender pedicels, in 1 or 2-fruited clusters, subglobose to short-oblong, rounded at the ends, dull brownish yellow marked by occasional dark dots, about $\frac{1}{3}'$ in diameter; calyx prominent, with an elongated tube, and spreading lobes usually deciduous before the fruit ripens; flesh thin, yellow, dry and mealy; nutlets 3, broad, rounded at the broad ends, rounded and sometimes obscurely grooved on the back, about $\frac{3}{8}'$ long.

A tree, occasionally 20° but usually not more than 10° high, with a tall trunk $4'$–$6'$ in diameter, covered with thick deeply furrowed black bark broken on the surface into thick plate-like closely appressed scales, long slender drooping branches forming a handsome symmetrical round-topped head; and thin glabrous very zigzag branchlets light orange-brown when they first appear, soon becoming reddish brown and lustrous, and dark gray-brown in their second year, and armed with many small nearly straight dark chestnut-brown spines $\frac{1}{2}'$–$\frac{3}{4}'$ long.

Distribution. Western Florida, Walton and Santa Rosa Counties (Pensacola to De Funiak Springs); sometimes in moist sand; more often in dry barrens; common and often a conspicuous feature of the vegetation.

127. Cratægus Ravenelii Sarg.

Leaves obovate, rounded and abruptly short-pointed or acute at the broad sometimes slightly lobed apex, gradually narrowed from above the middle to the elongated cuneate base, more or less undulate on the margins, and coarsely and usually doubly glandular-serrate above with large bright red ultimately dark persistent glands, nearly fully grown when the flowers open the middle of April, and then coated with long pale caducous hairs, and at maturity thin and firm in texture, yellow-green, scabrous on the upper surface, pale, and pubescent on the lower surface on the slender veins, 1′–1½′ long, and about ¾′ wide; petioles slender, glandular, winged above, tomentose when they first appear, becoming pubescent, ¼′–½′ in length; leaves at the end of vigorous shoots often 2′ long and 1½′ wide, and frequently divided above the middle into 2 or 3 pairs of broad lateral lobes. **Flowers** about ¾′ in diameter, on slender tomentose pedicels, in simple corymbs; calyx-tube narrowly obconic, thickly coated with long white hairs, the lobes lanceolate, villose on the outer, glabrous on the inner surface, glandular with small red glands; stamens 20; anthers

Fig. 479

small, pale yellow; styles 5, surrounded at base by a broad ring of pale tomentum. **Fruit** ripening early in October, on short thick pedicels, in few-fruited drooping or spreading clusters, globose to short-oblong, bright orange-red, marked by occasional dark dots, puberulous at the ends, ⅓′–½′ in diameter; calyx prominent, with enlarged spreading and appressed lobes; flesh thick, yellow, subacid; nutlets 5, narrowed and acute at the ends, ridged on the back with a high narrow ridge, ½′ long.

A tree, 25°–30° high, with a trunk often 14′ or 15′ in diameter, covered with thick dark brown bark deeply divided into narrow interrupted ridges broken on the surface into short thick plate-like scales, heavy ascending or spreading branches forming an open irregular head, and stout zigzag branchlets thickly coated at first with hoary tomentum, dark purple or red-brown and pubescent during their first summer, becoming dark red-brown and glabrous the following season, and armed with thick straight dull gray-brown spines usually about 1½′ long.

Distribution. Sand hills near Aiken, Aiken County, South Carolina, and in Summerville near Augusta, Richmond County, Georgia.

128. Cratægus senta Beadl.

Leaves obovate or obovate-cuneiform, acute or sometimes rounded and frequently slightly divided into several short acute lobes at the broad apex, gradually narrowed from the middle to the entire base, and serrate or doubly serrate above with incurved conspicu-

ously glandular teeth, when they unfold often dark red, covered above with long pale caducous hairs and villose below on the midrib and veins, nearly fully grown when the flowers open from the 1st to the 10th of May and then bright yellow-green and almost glabrous with the exception of the persistent tufts of pale hairs in the axils of the veins, and at maturity thin and firm, dark green and lustrous above, paler below, usually about $1\frac{1}{2}'$ long and $1'$ wide, with an orange-colored midrib, generally 3 pairs of slender primary veins extending obliquely to the point of the lobes, and dark conspicuous reticulate veinlets; turning red, yellow, or brown in the autumn; petioles slender, glandular, wing-margined above, at first tomentose, becoming pubescent or nearly glabrous, about $\frac{3}{4}'$ in length; leaves at the end of vigorous shoots broad-ovate, often nearly orbicular, more deeply lobed with broad rounded or acute lobes, $2'$–$2\frac{1}{2}'$ in diameter, their stipules lunate, coarsely glandular-dentate, sometimes $\frac{1}{2}'$ long. **Flowers** $\frac{3}{4}'$ in diameter, on long slender pedicels coated with matted pale hairs, in lax compound 3–6-flowered villose corymbs, with lanceolate straight or falcate glandular bracts and bractlets; calyx-tube broadly obconic, villose particularly toward the base, the lobes narrow, elongated, acuminate,

Fig. 480

nearly glabrous, coarsely and irregularly glandular-serrate; stamens 20; styles 3–5, surrounded at base by a broad ring of hoary tomentum. **Fruit** ripening and falling at the end of September or early in October, on slender slightly hairy elongated pedicels, in few-fruited drooping clusters, globose, bright red, $\frac{1}{3}'$–$\frac{1}{2}'$ in diameter; calyx enlarged, with closely appressed lobes; flesh yellow, dry and mealy; nutlets 3–5, broad and rounded at apex, narrowed and acute at base, slightly grooved on the back, about $\frac{1}{2}'$ long.

Distribution. Abandoned fields and open Pine-woods near Asheville, Buncombe County, North Carolina, at altitudes of about 2200°.

129. Cratægus annosa Beadl.

Leaves obovate, oval, or oblanceolate, cuneate and glandular at base, sharply and often doubly glandular-serrate above, and usually slightly lobed toward the short-pointed acute apex, more than half grown when the flowers open early in April and then pale yellow-green and scurfy above, with a few short pale hairs above and below near the base of the midrib, and at maturity thin, glabrous, bright green, $1'$–$1\frac{1}{2}'$ long, and $\frac{3}{4}'$–$1'$ wide, with a prominent pale yellow midrib, and remote slender veins extending very obliquely to the point of the lobes; turning in the autumn yellow, orange, or brown; petioles slender, narrowly winged above, conspicuously glandular with large dark glands, $\frac{1}{2}'$–$\frac{5}{4}'$ in length; leaves at the end of vigorous shoots broad-ovate to obovate or suborbicular, coarsely serrate, conspicuously reticulate-venulose, sometimes $2'$ long and wide, with broadly winged petioles and folia-

ceous coarsely dentate persistent stipules often $\frac{3}{4}'$ long. **Flowers** $\frac{3}{4}'$ in diameter, on stout villose pedicels, in simple 3–5-flowered villose corymbs; calyx-tube narrowly obconic, sparingly villose toward the base, the lobes acute, glandular-serrate, glabrous on the outer surface, puberulous on the inner surface; stamens 20; anthers almost white; styles 3–5, surrounded at base by a broad ring of snow-white tomentum. **Fruit** ripening and falling late in August or early in September, subglobose or ellipsoidal, orange-red or red and orange,

Fig. 481

about $\frac{1}{2}'$ long; calyx little enlarged, the lobes puberulous on the upper side and reflexed; flesh thick and soft; nutlets 3–5, broad and rounded at base, narrowed and rounded at apex, rounded and ridged on the back with a broad low rounded ridge, about $\frac{5}{16}'$ long.

A tree, 20°–25° high, with a trunk sometimes a foot in diameter, covered with dark rough often black bark, stout spreading or ascending branches, and thick dull red-brown ultimately dark gray or nearly black branchlets armed with straight rather stout spines $1'$–$1\frac{1}{2}'$ long.

Distribution. Eastern central Alabama; common near Phœnix, Lee County, and Girard, Russell County.

130. Cratægus panda Beadl.

Leaves obovate, rounded and short-pointed or abruptly narrowed and acute at the broad occasionally slightly lobed apex, concave-cuneate and glandular at the entire base, and finely serrate above with minute incurved glandular teeth, when they unfold tinged with red and sparingly villose, nearly fully grown when the flowers open the 1st of April and then roughened above by short pale rigid hairs and villose above and below on the midrib and on the veins below, and at maturity glabrous, or puberulous on the under surface of the slender midrib, subcoriaceous, light green and lustrous, glandular, $1'$–$1\frac{1}{4}'$ long, and $\frac{3}{4}'$–$1'$ wide, with slender primary veins extending very obliquely toward the end of the leaf; turning yellow-brown or orange color in the autumn before falling; petioles slender, slightly wing-margined at apex, villose early in the season, becoming glabrous, glandular, about $\frac{3}{8}'$ in length; leaves at the end of vigorous shoots broad-ovate, rounded, apiculate and lobed at apex, puberulous and villose on the midrib and veins on the lower surface, often $1\frac{3}{4}'$ long and $2'$ wide. **Flowers** $\frac{5}{8}'$–$\frac{3}{4}'$ in diameter, on slender hairy pedicels, in compact 3–5-flowered simple corymbs; calyx-tube narrowly obconic, covered with matted white hairs, the lobes gradually narrowed from a broad base, acuminate, glandular-serrate, more or less villose; stamens 20; anthers nearly white; styles 3–5, surrounded at base by a narrow ring of pale hairs. **Fruit** ripening and falling at the end of August or early in September, on stout pedicels, in erect few-fruited clusters, globose or depressed-globose, orange-yellow, with a red

cheek, $\frac{3}{8}'$–$\frac{3}{4}'$ in diameter; calyx slightly enlarged, with closely appressed often deciduous lobes; flesh thick, succulent, orange-yellow; nutlets 3–5, narrowed and acute at the ends, grooved on the rounded back with a broad shallow groove, about $\frac{1}{4}'$ long.

Fig. 482

A tree, 20°–25° high, with a trunk sometimes a foot in diameter, covered with dark rough bark, crooked recurved branches forming an open irregular head, and stout branchlets covered at first with matted pale hairs, reddish brown and puberulous during their first season, becoming gray, and unarmed or occasionally armed with stout spines $\frac{1}{2}'$–$1'$ long.

Distribution. Dry sandy soil near Tallahassee, Leon County, Florida.

131. Cratægus integra Beadl.

Leaves obovate to oblong-obovate, narrowed from near the middle to the acute apex, concave-cuneate and gradually narrowed to the slender base, and finely serrate, nearly half

Fig. 483

grown when the flowers open about the 20th of March, and then glandular on the margins, slightly hairy on the midrib and on the under side of the veins, and at maturity subcoriaceous, bright green, lustrous, and glabrous above, paler below, $1'$–$1\frac{1}{4}'$ long, and about $\frac{3}{4}'$ wide,

with a thin yellow midrib puberulous below, slender primary veins extending very obliquely to the end of the leaf, with 1 or 2 pairs near the middle of the blade more prominent than those below and above them; turning in the autumn yellow, orange and brown; petioles slender, narrowly wing-margined above, glandular, at first hoary-tomentose, becoming pubescent or puberulous, $\frac{1}{2}'$–$\frac{3}{4}'$ in length; leaves at the end of vigorous shoots broadly obovate, short-pointed at apex, slightly undulate-lobed above the middle, sometimes $1\frac{1}{2}'$ long and broad. **Flowers** $\frac{5}{8}'$–$\frac{3}{4}'$ in diameter, on slender elongated hoary-tomentose pedicels, in 3–5-flowered simple corymbs; calyx-tube narrowly obconic, thickly covered with matted white hairs, the lobes gradually narrowed from a broad base, acuminate, glandular, pilose on the outer, sparingly pilose on the inner surface; stamens 20; anthers pale yellow; styles 3–5, surrounded at base by a thick ring of white hairs. **Fruit** ripening and falling in August, on slender erect pubescent pedicels, globose, red, about $\frac{1}{2}'$ in diameter; calyx deciduous; flesh thin, orange-yellow, and succulent; nutlets 3–5, narrowed and acute at the base, rounded at the apex, flat and grooved on the back with a narrow shallow groove, about $\frac{5}{16}'$ long.

A tree, 12°–15° high, with a trunk sometimes 8′ in diameter, covered with thick nearly black checkered bark, drooping branches forming a handsome symmetrical head, and slender very zigzag branchlets clothed when they first appear with hoary tomentum, rather bright reddish brown and roughened by minute tubercles at the end of their first season, becoming gray or grayish brown, and unarmed or armed with occasional short slender spines.

Distribution. Sandy woods and abandoned fields; central Florida; common near Eustis, Lake County, and Orlando, Orange County.

132. Cratægus recurva Beadl.

Leaves spatulate, rounded or acute or sometimes obovate and obtusely 3-lobed at apex, and finely glandular-serrate with bright red glands, nearly half grown when the flowers

Fig. 484

open about the 20th of March and then almost glabrous above, slightly hairy near the base below, and at maturity subcoriaceous, glabrous, about 1′ long and $\frac{1}{4}'$–$\frac{1}{2}'$ wide, with a slender yellow midrib and one pair of veins often more prominent than the others and nearly parallel with the margins of the blade; turning in the autumn yellow, orange, and brown; petioles slender, conspicuously glandular, villose when they first appear, becoming glabrous, $\frac{1}{4}'$–$\frac{1}{2}'$ in length; leaves at the end of vigorous shoots broad-obovate, deeply divided into narrow lateral ascending rounded lobes, concave-cuneate at base, with a stouter midrib, and veins arching to the point of the lobes, and often 1′ long and $\frac{3}{4}'$ wide. **Flowers**

$\frac{1}{2}'$–$\frac{5}{8}'$ in diameter, on stout pedicels thickly covered with matted pale hairs, solitary or in 2-flowered simple corymbs; calyx-tube broadly obconic, pilose below, nearly glabrous above, the lobes slender, acuminate, glandular-serrate, slightly hairy on the outer surface, glabrous on the inner surface; stamens 20; anthers pale yellow; styles 3–5. **Fruit** ripening in August, erect on short stout pedicels, obovoid, red, $\frac{1}{2}'$ long; calyx little enlarged, often deciduous; flesh thick and soft; nutlets 3–5, broad and rounded at the ends, rounded and obscurely grooved on the back, about $\frac{1}{4}'$ long.

A tree, 15°–18° high, with a short trunk 5′–6′ in diameter, covered with gray or brownish rough bark, slender pendulous branches forming a broad symmetrical head, and slender very zigzag branchlets, villose early in the season, becoming bright chestnut-brown and very lustrous and ultimately dark reddish brown, and armed with numerous slender straight spines usually about $\frac{1}{2}'$ long.

Distribution. Dry sandy soil, Ocala, Marion County, Florida.

133. Cratægus dispar Beadl.

Leaves broad-ovate or orbicular, 3-nerved, acute or rounded at apex, generally narrowed and cuneate or concave-cuneate at the glandular entire base, serrate or doubly serrate above with straight or incurved glandular teeth, and mostly divided above the middle into

Fig. 485

short acute lobes, when they unfold coated with long matted white hairs most abundant on the lower surface, more than half grown when the flowers open about the middle of April and then blue-green and villose above and tomentose below, and at maturity thin and firm in texture, blue-green and glabrous on the upper surface, pale and slightly pubescent on the lower surface, usually about 1′ long and $\frac{3}{4}'$–1′ wide; turning red, yellow, or brown in the autumn; petioles slender, tomentose, becoming pubescent or villose, glandular, slightly wing-margined above, usually about $\frac{1}{3}'$ in length; leaves at the end of vigorous shoots broad-ovate or suborbicular, rounded at the broad base, coarsely serrate, and often deeply divided above the middle into 3 wide acute lobes broader than long. **Flowers** about $\frac{5}{8}'$ in diameter, on slender hoary-tomentose pedicels, in simple 3–7-flowered corymbs, with narrow-obovate acute glandular bracts and bractlets; calyx-tube narrowly obconic, coated with hoary tomentum, the lobes narrow, acute, glandular-serrate with minute bright red glands, tomentose on the outer surface below the middle, glabrous above, tomentose on the inner surface; stamens 20; styles 3–5, surrounded at base by a ring of pale tomentum. **Fruit** ripening late in August or early in September, on slender pubescent pedicels, in few-fruited clusters, subglobose to short-oblong, light red, puberulous toward the ends, about $\frac{1}{3}'$ in diameter; calyx prominent, with reflexed closely appressed lobes tomentose at base;

flesh thin, yellow, subacid; nutlets 3–5, rounded at the ends, ridged on the back with a broad low ridge, dark brown, $\frac{1}{4}'$ long.

A tree, 20°–25° high, with a short trunk a foot in diameter, heavy ascending branches forming a broad irregular head, and stout zigzag branchlets at first hoary-tomentose, dark red-brown and pubescent during their first summer, becoming darker colored and glabrous the following season, and armed with thick or thin nearly straight dark red-brown ultimately gray spines $1\frac{1}{2}'$–$2'$ long.

Distribution. Dry sand hills near Aiken, Aiken County, and Trenton, Edgefield County, South Carolina; more abundant at Summerville, west of Augusta, Richmond County, Georgia.

134. Cratægus aprica Beadl.

Leaves broad-obovate, oval, or rhombic, acute and short-pointed or rounded and often somewhat lobed at apex, gradually or abruptly narrowed and cuneate at the entire base, and serrate usually only above the middle with small incurved teeth terminating in con-

Fig. 486

spicuous rose-colored ultimately dark red persistent glands, when they unfold deep orange color, roughened above by short pale appressed hairs and sparingly villose below, especially on the slender midrib and remote primary veins, nearly fully grown when the flowers open about the 10th of May, and at maturity thick and firm, glabrous, smooth, and dark yellow-green on the upper surface, pale on the lower surface, $1'$–$1\frac{1}{4}'$ long, and $1'$ wide; petioles stout, conspicuously glandular, more or less winged toward the apex, villose early in the season, becoming nearly glabrous, usually bright red on the lower side toward the base after midsummer, about $\frac{1}{2}'$ in length; leaves at the end of vigorous shoots often nearly orbicular, frequently more deeply lobed, and $1\frac{1}{2}'$–$2'$ long and wide, with a stout broadly winged petiole, and foliaceous lunate stipules. **Flowers** $\frac{3}{4}'$ in diameter, on slender villose pedicels, in small 3–6-flowered compact simple corymbs; calyx-tube broadly obconic, villose at base, glabrous above, the lobes gradually narrowed from a broad base, acuminate, glabrous, coarsely glandular-serrate; stamens 10; anthers small, bright yellow; styles 3–5, surrounded at base by a narrow ring of pale hairs. **Fruit** ripening late in the autumn, on stout glabrous or slightly villose pedicels, in erect or drooping usually 2 or 3-fruited clusters, subglobose, rarely rather longer than broad, about $\frac{1}{2}'$ in diameter, dull orange-red, often slightly villose at the ends, marked by numerous small dark dots; calyx much enlarged, with wide-spreading coarsely glandular acuminate lobes bright red at base on the upper side; flesh thin, light yellow, sweet and rather juicy; nutlets 3–5, broad and rounded at the ends, rounded and ridged on the back with a broad low ridge, about $\frac{1}{4}'$ long.

A tree, occasionally 20° high, with a stem 6′–8′ in diameter, covered with deeply furrowed dark gray bark broken irregularly into small persistent plate-like scales, and becoming on old stems often nearly black, spreading often elongated contorted branches forming a broad open head, and slender zigzag branchlets dark green tinged with red and villose when they first appear, soon becoming nearly glabrous, light orange-brown at midsummer, dark reddish brown or purple before winter, and ultimately ashy gray, and armed with thin nearly straight chestnut-brown spines 1′–1½′ long; or frequently a much-branched shrub, with several stout spreading stems.

Distribution. Dry woods in the foothill region of the southern Appalachian Mountains; southwestern Virginia through western North Carolina to eastern Tennessee and northern Georgia; in northern Alabama; usually at altitudes between 1500° and 3500°; common.

XVI. MICROCARPÆ.

CONSPECTUS OF THE ARBORESCENT SPECIES.

Fruit short-oblong; leaves orbicular to broad-ovate, pinnately 5–7-cleft.
135. **C. apiifolia** (C).

Fruit subglobose.

Leaves broad-ovate to triangular, long-stalked; calyx deciduous from the fruit.
136. **C. Phænopyrum** (A, C).

Leaves spatulate to oblanceolate, short-stalked; calyx generally persistent on the fruit.
137. **C. spathulata** (C).

135. Cratægus apiifolia Michx. Parsley Haw.

Leaves broad-ovate to orbicular, acute at apex, truncate, slightly cordate or cuneate at the broad base, and pinnately 5–7-cleft with shallow acute or deep wide sinuses, and incisely lobed with broad or acute segments serrate toward the apex with spreading glandu-

Fig. 487

lar teeth, when they unfold pilose above with long pale hairs, and mostly glabrous below, fully grown when the flowers open late in March or early in April, and at maturity thin, bright green and rather lustrous above, paler and glabrous or pilose below on the prominent midrib and primary veins, or on occasional plants pubescent on both surfaces, ⅔′–1½′ wide; petioles slender, pubescent, becoming glabrous, 1′–1½′ in length; leaves at the end of vigorous shoots often divided nearly to the midrib, with foliaceous lunate coarsely glandular-serrate short-stalked stipules sometimes ½′ long. **Flowers** ½′ in diameter, on long slen-

der hairy pedicels, in crowded densely villose usually 10–12-flowered corymbs; calyx-tube narrowly obconic, glabrous or covered with long matted pale hairs, the lobes lanceolate, acute, glabrous, usually glandular-serrate, often tinged with red toward the apex; stamens 20; anthers bright rose color; styles 1–3. **Fruit** ripening in October and persistent on the branches until the beginning of winter, short-oblong, bright scarlet, $\frac{1}{3}'$ long; calyx prominent, the lobes elongated, reflexed, often deciduous from the ripe fruit; flesh thin; nutlets 1–3, rounded at the ends, about $\frac{1}{3}'$ long.

A tree, occasionally 20° high, with a trunk rarely 6′–8′ in diameter, branches spreading nearly at right angles and forming a wide irregular open head, and slender more or less zigzag often contorted branchlets covered when they first appear with long pale hairs, light red or pale orange-brown and usually puberulous in their first winter, ultimately light brown or ashy gray, and armed with stout straight chestnut-brown spines $1'–1\frac{1}{2}'$ long.

Distribution. Borders of streams and swamps or in hummocks in Pine-barrens in the coast and Piedmont regions of the south Atlantic States from southeastern Virginia to Georgia; in western Florida south to Dixie County (near Old Town), north-central and southern Alabama, Louisiana and the coast region of Texas to the valley of the lower Colorado River (low woods, Peyton's Creek, Matagorda County), and through Arkansas to eastern Oklahoma (Page, Le Flore County) and to southeastern Missouri; most abundant and of its largest size in southern Arkansas and western Louisiana.

136. Cratægus Phænopyrum Med. Washington Thorn.

Cratægus cordata Ait.

Leaves broad-ovate to triangular, acute or acuminate, truncate, broad-cuneate, rounded or cordate at the entire base, coarsely serrate above with acute spreading often gland-tipped teeth, and more or less incisely lobed or often 3-lobed, tinged with red when they

Fig. 488

unfold and sparingly pilose above with long pale caducous hairs, fully grown when the flowers open at the end of May, and at maturity thin and firm, dark green and lustrous above, pale and rarely pubescent on the lower surface, especially on the conspicuous orange-colored midrib and primary veins, $1\frac{1}{2}'–2'$ long, and $1'–1\frac{1}{2}'$ wide; turning late in the autumn bright scarlet and orange; petioles slender, terete, glabrous, $\frac{3}{4}'–1\frac{1}{2}'$ in length. **Flowers** on slender pedicels, in rather compact many-flowered glabrous corymbs; calyx-tube broadly obconic, glabrous, the lobes short, nearly triangular, entire, abruptly contracted at apex into a minute point, glabrous on the outer, pubescent on the inner surface, ciliate on the margins; stamens 20; anthers rose color; styles 2–5, surrounded at base by

conspicuous tufts of pale hairs. **Fruit** ripening in September and October and persistent on the branches until the spring of the following year, depressed-globose, scarlet, lustrous, $\frac{1}{4}'$ in diameter; calyx deciduous from the ripe fruit, leaving a wide circular scar surrounding the persistent erect tips of the carpels; nutlets 3–5, narrowed and acute at base, broad and rounded at apex, about $\frac{1}{8}'$ long.

A tree, 20°–30° high, with a straight trunk sometimes a foot in diameter, generally dividing 4°–5° above the ground into slender usually upright branches forming an oblong or occasionally round-topped head, slender zigzag glabrous bright chestnut-brown lustrous branchlets, becoming dark gray or reddish brown, and armed with slender sharp spines $1\frac{1}{2}'$–$2'$ long; often much smaller, and sometimes a broad spreading bush.

Distribution. Banks of streams in rich soil; western North Carolina at altitudes of about 2000°, to middle Tennessee and southern Kentucky; in southern Missouri (St. Francois, Wayne, Shannon, Carter and Ripley Counties), and in Richland County, Illinois; now often naturalized in the middle and Ohio valley states; nowhere common. Often cultivated in the eastern states and in western Europe; hardy as far north as eastern Massachusetts.

137. Cratægus spathulata Michx.

Cratægus spathulata var. *flavanthera* Sarg.

Leaves spatulate to oblanceolate, rounded or acuminate and sometimes 3-lobed at apex, gradually narrowed from above the middle to the slender concave-cuneate entire base, and crenately serrate above, nearly fully grown when the flowers open from March to May and

Fig. 489

then sparingly villose above with long white caducous hairs, and at maturity subcoriaceous, glabrous, dark green and lustrous above, paler below, reticulate-venulose, with an obscure yellow midrib and primary veins, $1'$–$2'$ long, and $1'$–$1\frac{1}{2}'$ wide, clustered at the end of short lateral branchlets; petioles slender, wing-margined to the base, $\frac{1}{8}'$–$\frac{1}{4}'$ in length; leaves at the end of vigorous shoots often deeply 3-lobed above the middle with rounded coarsely crenately serrate lobes, and narrowed below into a long winged petiole, $1'$–$2'$ long, and $1'$–$1\frac{1}{2}'$ wide, with a broad thick midrib often pilose on the lower surface, their stipules foliaceous, lunate, sharply serrate, stalked, often $\frac{1}{2}'$ broad. **Flowers** $\frac{1}{2}'$ in diameter, on long slender pedicels, in glabrous many-flowered narrow corymbs; calyx-tube broadly obconic, glabrous, the lobes short, nearly triangular, almost entire, minutely glandular-apiculate; stamens 20; anthers pale yellow; styles 2–5. **Fruit** ripening in October, sub-

globose, bright scarlet, lustrous, about $\frac{1}{3}'$ in diameter; calyx only slightly enlarged, with reflexed lobes; flesh thin, dry and mealy; nutlets 3–5, broad and rounded at apex, narrowed at base, $\frac{1}{16}'$–$\frac{1}{8}'$ long.

A tree, 18°–25° high, with a straight trunk occasionally 8′–10′ in diameter, slender upright and spreading branches forming a broad open head, and thin zigzag glabrous light reddish brown branchlets, unarmed, or armed with straight stout light brown spines 1′–$1\frac{1}{2}'$ long; more often a shrub, with numerous spreading stems.

Distribution. Rich soil usually near the banks of streams or swamps, or low depressions in Pine-forests; North Carolina (near Albemarle, Stanly County) to central South Carolina, central, northwestern (Rome, Floyd County), and southwestern Georgia to northern Florida (Ocala, Marion County, to River Junction, Gadsden County); northern Alabama southward to Dallas County; eastern and western Mississippi (near Natchez, Adams County) eastern and northwestern Louisiana (Richland, Rapides, Caddo and Natchitoches Parishes); eastern Texas to the valley of the Guadalupe River (near Seguin, Guadalupe County), southeastern Oklahoma (Bennington, Bryan County), and through southern and western Arkansas to southwestern Missouri (Taney and Jasper Counties); probably most abundant in central Georgia.

XVII. BRACHYACANTHÆ.

CONSPECTUS OF THE ARBORESCENT SPECIES.

Leaves oblong-lanceolate to ovate or rhombic; broad-ovate to nearly triangular on vigorous shoots; fruit subglobose to obovoid, bright blue covered with a glaucous bloom. 138. **C. brachyacantha** (C).

Leaves narrow-rhombic to oval; lanceolate, acuminate on vigorous shoots; fruit globose, blue-black, very lustrous. 139. **C. saligna** (F).

138. Cratægus brachyacantha Sarg. & Engelm. Pomette Bleue.

Leaves oblong-lanceolate to ovate or rhombic, acute or rounded at apex, gradually narrowed to the concave-cuneate entire base, and crenulate-serrate above with minute incurved glandular teeth, slightly puberulous when they unfold on the upper surface and glabrous

Fig. 490

on the lower surface, nearly fully grown when the flowers open at the end of April and early in May, and at maturity subcoriaceous, glabrous, dark green and lustrous, 1′–2′ long, and $\frac{1}{2}'$ to nearly 1′ wide, with a thin inconspicuous midrib and veins; petioles slender, narrowly

wing-margined above, $\frac{1}{2}'$–$\frac{3}{4}'$ in length; leaves at the end of vigorous shoots sometimes broad-ovate or almost triangular, cuneate, truncate or cordate at the broad base, more or less deeply lobed, frequently $2\frac{1}{2}'$ long and $2'$ wide, with foliaceous broadly ovate to triangular acute stalked stipules sometimes $1'$ long. **Flowers** $\frac{1}{3}'$ in diameter, on slender pedicels, in crowded glabrous many-flowered corymbs; calyx-tube narrowly obconic, glabrous, the lobes short, nearly triangular, gradually narrowed to the gland-tipped apex, entire; petals turning bright orange color in fading; stamens 15–20; anthers yellow; styles 3–5. **Fruit** ripening and falling the middle of August, on erect pedicels, in few-fruited clusters, subglobose or obovoid, bright blue, covered with a glaucous bloom, $\frac{1}{3}'$–$\frac{1}{2}'$ in diameter; calyx slightly enlarged, with spreading lobes; flesh thin; nutlets 3–5, narrowed and acute at base, full and rounded at apex, rounded and slightly grooved on the back, about $\frac{1}{4}'$ long.

A tree, 40°–50° high, with a trunk 18′–20′ in diameter, covered with thick dark brown deeply furrowed scaly bark, and divided usually 5°–10° from the ground into stout spreading light gray branches forming a broad compact round-topped head, and branchlets light green and slightly pubescent early in the season, soon becoming glabrous and pale red-brown, and ultimately ashy gray, and armed with numerous short stout generally curved or sometimes straight slender spines $\frac{1}{3}'$–$\frac{2}{3}'$ long, and also often terminal on the lateral branchlets of vigorous shoots.

Distribution. Borders of streams in rich moist soil; southwestern Arkansas (Ashdown, Little River County, and Texarkana, Miller County) to the valley of the Trinity River (Livingston, Polk County), eastern Texas, and to western Louisiana (Caddo, Webster, Ouachita, Natchitoches, St. Landry and Jefferson Davis Parishes); in eastern Louisiana (Glen Gordon, Covington, St. Tammany Parish; common); a few miles west of Opelousas, Louisiana, surrounding with dense groves low wet prairies and a conspicuous and beautiful feature of arborescent vegetation.

139. Cratægus saligna Greene.

Leaves narrow-rhombic to oval, gradually narrowed at the ends, acute or acuminate and apiculate at apex, entire toward the base, finely serrate above with incurved teeth tipped with minute bright red glands, nearly fully grown when the flowers open toward the middle

Fig. 491

of June, and then light yellow-green, covered above with short pale hairs and pale and glabrous below, and at maturity thick and firm, dark green, glabrous and lustrous above, pale below $1\frac{1}{2}'$–$2'$ long, and $\frac{3}{4}'$–$1'$ wide, with a stout midrib rose color on the upper side, dark obscure forked veins, and reticulate veinlets; turning late in the autumn to brilliant shades of

orange and bright scarlet; petioles slender, glandular near the base, with 2 or 3 large stipitate dark red caducous glands, and about $\frac{1}{3}'$ in length; leaves at the end of vigorous shoots lanceolate, acuminate, coarsely serrate, often irregularly and deeply divided into 2 or 3 acute lateral lobes, $3'$–$3\frac{1}{2}'$ long, and $1\frac{1}{4}'$–$1\frac{1}{2}'$ wide. **Flowers** about $\frac{5}{8}'$ in diameter, on short slender pedicels, in compact glabrous few or many-flowered corymbs; calyx-tube glabrous, the lobes nearly triangular, entire, often bright red toward the apex; stamens 20; anthers small, yellow; styles 5. **Fruit** ripening toward the end of September, on stout pedicels, in compact drooping clusters, globose, $\frac{1}{4}'$ in diameter, dull vinous red and very lustrous when fully grown, ultimately blue-black; calyx small, with reflexed persistent lobes; flesh thin, yellow, dry and sweet; nutlets 5, thick, rounded and slightly ridged on the back, $\frac{1}{8}'$–$\frac{3}{16}'$ long.

A tree, occasionally 20° high, with a short stem, long slender spreading branches gracefully drooping at the ends, covered with bright red or reddish brown bark, separating on old trunks near the ground into long slightly attached narrow plate-like gray scales, and slender glabrous bright red lustrous branchlets armed with numerous straight slender spines $\frac{3}{4}'$–$1\frac{1}{2}'$ long; often forming clumps or small thickets with numerous stems 8°–15° tall springing from a single root.

Distribution. Banks of the Cimarron, Gunnison, White, Tomichi, Eagle, San Juan, and other Colorado streams on both slopes of the continental divide at altitudes of 6000°–8000° above the sea.

XVIII. MACRACANTHÆ.

Tomentosæ Sarg.

CONSPECTUS OF THE ARBORESCENT SPECIES.

Leaves thin, with midrib and veins only slightly impressed on their upper surface; anthers rose color or red.
  Mature leaves pale pubescent below.
    Leaves ovate to ovate-oblong; fruit in erect clusters, obovoid, orange-red; stamens 20. **140. C. tomentosa** (A, C).
    Leaves ovate, oval, or obovate, fruit in drooping clusters, globose to subglobose, bright red or orange-red; stamens 5–10. **141. C. Chapmanii** (A, C).
  Mature leaves glabrous (*slightly pubescent on the midrib and veins below in* 142).
    Stamens 20.
      Leaves elliptic to suborbicular, smooth above; fruit in drooping clusters, subglobose to short-oblong. **142. C. Gaultii** (A).
      Leaves elliptic, scabrate above; fruit in erect clusters, subglobose. **143. C. vegeta** (A).
    Stamens 10; leaves ovate, scabrate above; fruit short-oblong. **144. C. Deweyana** (A).
Leaves subcoriaceous to coriaceous, with midrib and veins deeply impressed on their upper surface and pubescent below.
  Anthers rose color.
    Stamens 20.
      Leaves elliptic, acute at the ends; fruit globose. **145. C. succulenta** (A).
      Leaves broadly oval or obovate; fruit subglobose to short-oblong. **146. C. gemmosa** (A).
    Stamens 10.
      Leaves broad-obovate or oval; fruit globose, villose at the ends; calyx-lobes coarsely glandular-serrate. **147. C. illinoiensis** (A).
      Leaves broad-obovate to oval or rhombic; fruit subglobose; calyx-lobes entire. **148. C. integriloba** (A).
  Anthers yellow; stamens 10; leaves broad-obovate to elliptic or oval; fruit in erect clusters, globose. **149. C. macracantha** (A).

140. Cratægus tomentosa L.

Leaves ovate, oblong-ovate, rhombic or elliptic, acute, acuminate or rarely rounded at apex, gradually narrowed to the cuneate entire base, sharply and usually doubly serrate above with broad spreading usually glandular teeth, and often divided above the middle into several short lateral lobes, nearly fully grown when the flowers open from the 1st to the middle of June, and at maturity thin and firm, gray-green, coated below with pale persistent pubescence, puberulous or ultimately glabrous above, conspicuously reticulate-venulose, 2′–5′ long, and 1′–3′ wide, with a broad midrib and slender primary veins; turning brilliant orange and scarlet in the autumn before falling; petioles stout, glandular, wing-margined, ½′–¾′ in length; leaves at the end of vigorous shoots sometimes broad-obovate to semi-orbicular, rounded and abruptly short-pointed at apex, rounded at base, and 3′–4′ long and wide; more often oblong-obovate, acuminate, and 5′–6′ in length. **Flowers** ½′ in diameter, on slender villose pedicels, in villose corymbs; calyx-tube obconic, hoary-tomentose,

Fig. 492

the lobes lanceolate, acute, coarsely or pinnately serrate, usually glandular; stamens 20; anthers pale rose color; styles 2–5. **Fruit** ripening in October, on slender erect pubescent pedicels, in broad many-fruited clusters, obovoid or rarely subglobose, ½′ in diameter, erect, dull orange-red, translucent when fully ripe, mostly persistent on the branches until the following spring; flesh thick, orange-yellow, sweet and succulent; nutlets about ¼′ long and broad, rounded at the ends, the ventral cavities broad and deep.

A tree, 15°–20° high, with a trunk 5′–6′ in diameter, covered with smooth pale gray or dark brown furrowed bark, slender spreading often nearly horizontal smooth gray branches forming a wide flat head, and slender branchlets covered when they first appear with thick hoary tomentum, becoming dark orange color and puberulous in their first winter, and ashy gray in their second season, and unarmed, or armed with occasional slender straight dull ashy gray or very rarely bright chestnut-brown spines 1′–1½′ long.

Distribution. Near Troy, Rensselaer County, New York, westward through New York to southwestern Ontario, through Ohio, southern Michigan, Indiana and Illinois to central Minnesota and southward to Pennsylvania and along the Appalachian Mountains to northeastern Georgia, and to central Iowa, northeastern Missouri to the valley of the Meramec River, and to eastern Kansas; near Nashville, Davidson County, Tennessee; in the neighborhood of Augusta, Richmond County, Georgia; and in Dallas County, Alabama (*R. S. Cocks*).

Occasionally cultivated as an ornamental tree in the gardens of western Europe.

141. Cratægus Chapmanii Ashe.

Cratægus mollita Sarg.

Leaves ovate, oval, or obovate, acuminate, gradually narrowed and acute or concave-cuneate at the entire base, sharply serrate above with glandular teeth, and often slightly lobed above the middle, about half grown when the flowers open early in June and then covered above with short soft pale hairs and pale-tomentose below, and at maturity dark dull green and smooth or scabrate above, pale-tomentulose below, especially on the slender yellow midrib and primary veins, $2\frac{1}{2}'$–$3'$ long, and $1\frac{1}{2}'$–$2\frac{1}{2}'$ wide; turning yellow or brown in the autumn before falling; petioles stout, wing-margined at apex, tomentose early in the season, becoming nearly glabrous, $\frac{1}{2}'$–$\frac{3}{4}'$ in length; leaves at the end of vigorous shoots sometimes 6′ long and 4′ wide. **Flowers** about $\frac{3}{8}'$ in diameter, on long stout hoary-tomentose or pubescent pedicels, in broad many-flowered tomentose corymbs; calyx-tube narrowly obconic, tomentose, the lobes acuminate, glandular-serrate, sparingly villose; stamens 10; anthers rose color; styles 2 or 3. **Fruit** ripening the middle of September, on elongated slightly villose pedicels, in broad lax drooping many-fruited clusters, globose to subglobose, bright red, about $\frac{3}{8}'$ in diameter; calyx only slightly enlarged, with reflexed coarsely glandular-serrate lobes; flesh juicy, succulent, yellow; nutlets 2 or 3, about $\frac{3}{4}'$ long and nearly as broad, thin, rounded at the obtuse ends, rounded and obscurely ridged on the back, the ventral cavities broad and deep.

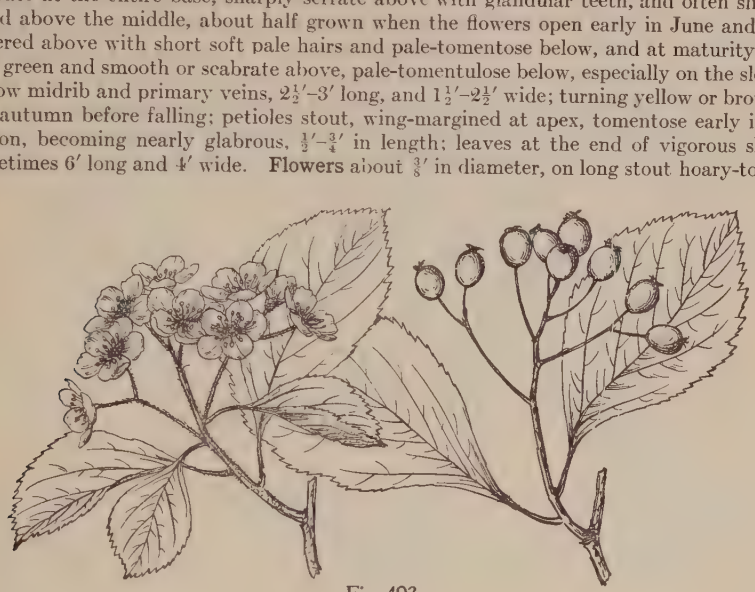

Fig. 493

A tree, sometimes 20° high, with a short trunk 6′–8′ in diameter, covered with gray scaly bark, erect branches forming a broad open head, and slender branchlets hoary-tomentose early in the season, becoming bright red-brown and lustrous, and armed with occasional stout straight or curved bright chestnut-brown spines $1\frac{1}{2}'$–$2'$ long.

Distribution. Banks of streams in the Appalachian region from Virginia to northern Georgia and eastern Tennessee; in southern Missouri (Taney County, *C. mollita*).

142. Cratægus Gaultii Sarg.

Leaves elliptic to suborbicular, acute or rounded at apex, concave-cuneate or rounded at the entire base, coarsely doubly serrate above with straight glandular teeth, and occasionally divided above the middle into short acute lobes, nearly fully grown when the flowers open at the end of May and then very thin, yellow-green and sparingly villose above, pale and slightly pubescent below, and at maturity thin and firm in texture, glabrous, dark dull green on the upper surface, pale on the lower surface, $2\frac{1}{2}'$–$3'$ long, and $2'$–$2\frac{3}{4}'$ wide, with a stout yellow midrib deeply impressed above, and 6 or 7 pairs of primary veins extending

obliquely to the point of the lobes; petioles stout, wing-margined to below the middle, villose on the upper side early in the season with matted white hairs, becoming nearly glabrous, $\frac{1}{2}'$–$1'$ in length. **Flowers** $\frac{5}{8}'$ in diameter, on long slender slightly villose pedicels, in broad many-flowered hairy corymbs, their bracts and bractlets linear, acuminate, glandular, mostly persistent until the flowers open; calyx-tube narrowly obconic, glabrous, the lobes broad, acuminate, coarsely glandular-serrate, glabrous on the outer, villose on the inner surface; stamens 18–20; anthers pale pink; styles 2 or 3. **Fruit** ripening from the middle to the end of September, on slender slightly hairy pedicels, in few-fruited drooping clusters, subglobose to short-oblong, $\frac{1}{2}'$–$\frac{5}{8}'$ long; calyx prominent, with spreading appressed coarsely serrate lobes; flesh thick, yellow, soft and juicy; nutlets 2 or 3, rounded at the ends, about $\frac{3}{16}'$ long and nearly as wide, the ventral cavities long, deep, and narrow.

A tree, 20°–25° high, with a trunk often 10′ in diameter and 6°–7° long, spreading

Fig. 494

branches forming a broad round-topped head, and slender slightly zigzag glabrous light red-brown lustrous branchlets, unarmed, or armed with occasional straight slender dark purple shining spines $1\frac{1}{4}'$–$1\frac{3}{4}'$ long.

Distribution. Open pastures, Milton Township and Gleneilyn, Du Page County, and Mokena, Will County, northeastern Illinois.

143. Cratægus vegeta Sarg.

Leaves elliptic, acuminate, gradually narrowed and concave-cuneate at the entire base, finely often doubly serrate above, with straight glandular teeth, and slightly divided above the middle into numerous short acute lobes, nearly fully grown when the flowers open at the end of May and then membranaceous, dark yellow-green and roughened above by short rigid pale hairs and densely pubescent below, and at maturity thin and firm in texture, dark dull green and scabrate on the upper surface, pale and pubescent on the lower surface on the slender midrib, and 5 or 6 pairs of thin primary veins arching obliquely to the point of the lobes, $3'$–$4'$ long, and $1\frac{3}{4}'$–$2\frac{1}{2}'$ wide; petioles slender, broadly wing-margined at apex, villose on the upper side early in the season, becoming glabrous and rose color in the autumn, $\frac{1}{2}'$–$\frac{3}{4}'$ long. **Flowers** $\frac{5}{8}'$–$\frac{3}{4}'$ in diameter, on long slender villose pedicels, in usually 10–12-flowered hairy corymbs, with linear to linear-obovate acute glandular bracts and bractlets becoming reddish and mostly persistent until after the flowers open; calyx-tube narrowly obconic, villose, the lobes slender, acuminate, glandular-serrate, villose; stamens 20; anthers small, light pink or red; styles 2 or 3, usually 3. **Fruit** ripening late in September, on slender elongated rigid slightly villose pedicels, in few-fruited erect clusters, subglobose, scarlet, lustrous, marked by small pale dots, about $\frac{3}{8}'$ in diameter; calyx prominent, with a short

tube and spreading reflexed serrate lobes; flesh thin, yellow, dry and mealy; nutlets 2 or 3, $\frac{1}{4}'$ long and nearly as broad, full and rounded at the ends, the ventral cavities broad and deep.

A tree, 20°–25° high, with a tall straight trunk sometimes 8′ in diameter, stout wide-spreading branches forming a symmetrical round-topped head, and very slender nearly

Fig. 495

straight branchlets, light orange-green when they first appear, becoming bright red-brown and lustrous at the end of their first season and darker the following year, and unarmed, or sparingly armed with slender nearly straight purple shining spines about 4′ long.

Distribution. Oak-woods in moist rich soil near the banks of the Calumet River, Calumet, Cook County, Illinois.

144. Cratægus Deweyana Sarg.

Leaves ovate, acuminate or abruptly long-pointed at apex, abruptly narrowed and concave-cuneate at the entire often unsymmetric base, coarsely doubly serrate above with straight or incurved gland-tipped teeth, and slightly divided above the middle into several pairs of small acuminate spreading lobes, about one third grown when the flowers open during the last week of May and then membranaceous, dark yellow-green, and covered above with short lustrous white hairs, and light yellow-green and glabrous below, and at maturity thin, yellow-green and scabrate on the upper surface, pale on the lower surface, 3′–4′ long, and 2′–$\frac{3}{4}'$ wide, with a stout midrib deeply impressed on the upper side, and 6 or 7 pairs of thin primary veins arching to the point of the lobes; petioles stout, wing-margined at apex, deeply grooved, sparingly villose on the upper side, soon glabrous, glandular with occasional minute dark glands, usually dull orange color in the autumn, $\frac{3}{4}'$–1′ in length; leaves at the end of vigorous shoots more deeply lobed and more coarsely serrate, subcoriaceous, often 4′ long and $3\frac{1}{2}'$ wide, and gradually narrowed into stout broad-winged coarsely glandular petioles, their stipules foliaceous, stipitate, lunate, acutely lobed, glandular-serrate with minute dark red glands, sometimes $\frac{1}{2}'$ long, persistent through the season. **Flowers** about $\frac{1}{2}'$ in diameter, on slender hairy pedicels, in wide lax slightly villose corymbs; calyx-tube narrowly obconic, villose at base, glabrous above, the lobes slender, elongated, acuminate, finely glandular-serrate usually only above the middle, dark green and glabrous on the outer surface, villose on the inner surface; stamens 7–10, usually 10; anthers small, dark rose color; styles 2 or 3, usually 2. **Fruit** ripening from the first to the middle of October and falling a few weeks later, on long slender puberulous pedicels, in wide many-fruited drooping clusters, subglobose to short-oblong, rounded at the ends, scarlet, lustrous,

marked by occasional large pale dots, $\frac{1}{2}'$ in diameter; calyx prominent, with elongated glandular-serrate lobes dark red on the upper side near the base, usually erect and incurved, mostly persistent on the ripe fruit; flesh when fully ripe thick, yellow and sweet; nutlets usually 2, occasionally 3, about $\frac{3}{16}'$ long and $\frac{1}{8}'$ wide, rounded at the ends, rounded and conspicuously ridged on the back, the ventral cavities broad and shallow.

A tree, 20°–25° high, with a tall trunk sometimes 10′ in diameter, covered with light gray

Fig. 496

bark becoming rough and scaly near the base, slender branches, the lower horizontal and wide-spreading, the upper ascending and forming a wide open irregular head, and stout glabrous branchlets dark orange-brown when they first appear, deep red-brown and lustrous on the upper, gray-brown and lustrous on the lower side during their first winter, becoming gray slightly tinged with red the following year, and armed with numerous stout curved chestnut-brown or purple spines $1\frac{1}{2}'$–$2'$ long and occasionally persistent on old stems.

Distribution. Western and central New York; Hagaman swamp near Rochester, and Rush, Monroe County, Portage, Livingston County, Castile and Silver Springs, Wyoming County, and near Ithaca, Tompkins County; not common.

145. Cratægus succulenta Link.

Leaves elliptic, acute or acuminate at apex, gradually narrowed from near the middle to the entire base, coarsely and usually doubly serrate above with spreading glandular teeth, and divided above the middle into numerous short acute lobes, nearly fully grown when the flowers open at the end of May or early in June and then membranaceous, covered above with soft pale hairs, and puberulous or rarely nearly glabrous below, and at maturity coriaceous, dark green, glabrous and somewhat lustrous above, pale yellow-green and mostly puberulous below on the stout yellow midrib, and 4–7 pairs of slender veins extending obliquely to the point of the lobes and deeply impressed on the upper side, usually $2'$–$2\frac{1}{2}'$ long and $1'$–$1\frac{1}{2}'$ wide; petioles stout, more or less winged above, frequently bright red after midsummer, generally about $\frac{1}{2}'$ in length; leaves at the end of vigorous shoots occasionally ovate, and often $2\frac{1}{2}'$ long and $3'$ wide. **Flowers** about $\frac{2}{3}'$ in diameter, on long slender hairy pedicels, in broad lax villose corymbs; calyx-tube narrowly obconic, villose or glabrous, the lobes broad, acute, laciniate, glandular with bright red glands, and generally villose; stamens usually 20, sometimes 15; anthers small, rose color; styles 2 or 3, surrounded at base by a ring of pale hairs. **Fruit** beginning to ripen about the middle of September and sometimes remaining on the branches until the end of October, on slender elongated pedicels, in

broad loose many-fruited drooping clusters, globose, bright scarlet, marked by large pale dots, $\frac{1}{2}'$–$\frac{2}{3}'$ in diameter; calyx prominent, with a broad shallow depression, and much enlarged coarsely serrate closely appressed persistent lobes; flesh thick, yellow, becoming juicy, sweet and pulpy; nutlets 2 or 3, $\frac{1}{3}'$ long, $\frac{1}{4}'$ broad, prominently ridged on the back, the ventral cavities wide and deep.

A tree, occasionally 20° high, with a short trunk 5′–6′ in diameter, covered with dark red-brown scaly bark, stout ascending branches forming a broad irregular head, and stout more or less zigzag glabrous dark orange-brown lustrous branchlets becoming dull gray-brown

Fig. 497

in their second season and ultimately ashy gray, and armed with numerous stout slightly curved bright chestnut-brown shining spines $1\frac{1}{2}'$–$2\frac{1}{2}'$ long; or usually shrubby and much smaller, and often flowering when only a few feet high.

Distribution. Coast of northeastern Massachusetts; southwestern Vermont; eastern and western New York; near London, Ontario; widely distributed in Pennsylvania; northeastern Illinois.

146. Cratægus gemmosa Sarg.

Leaves broad-oval or rarely broad-obovate, gradually narrowed and cuneate or occasionally rounded at the entire base, sharply and usually doubly serrate from below the middle with straight glandular teeth, and often slightly lobed toward the acute or acuminate apex with short acute lobes, dark red and villose as they unfold, nearly fully grown when the flowers open from the middle to the end of May and then membranaceous, light yellow-green, nearly glabrous above and pale and villose below, and at maturity thick and firm in texture, very dark dull green on the upper surface, pale on the lower surface and pubescent on the under side of the stout yellow midrib deeply impressed and occasionally puberulous above, and on the 4 or 5 pairs of slender primary veins extending obliquely to the end of the leaf, $1\frac{1}{2}'$–$2\frac{1}{2}'$ long, and 1′–2′ wide; petioles stout, villose or pubescent, more or less winged above, glandular while young with minute bright red caducous glands, usually pink in the autumn, $\frac{1}{4}'$–$\frac{1}{2}'$ in length; leaves at the end of vigorous shoots more coarsely serrate, frequently divided into short acute lateral lobes, and often 4′ long and 3′ wide, with a rose-colored midrib and stout spreading primary veins. **Flowers** $\frac{1}{2}'$–$\frac{3}{4}'$ in diameter, on slender hairy pedicels, in broad open compound villose many-flowered corymbs, with lanceolate or oblanceolate acuminate glandular-serrate conspicuous bracts and bractlets; calyx-tube narrowly obconic, more or less villose with matted pale hairs, or nearly glabrous, the lobes lanceolate, acuminate, glabrous or villose on the outer surface, villose on the inner surface, coarsely glandular-serrate with bright red glands; stamens 20; anthers small, rose color; styles 2

or 3, surrounded at the base by a narrow ring of pale tomentum. **Fruit** ripening early in October and becoming very succulent just before falling, on long slender pedicels, in drooping many-fruited glabrous or puberulous clusters, subglobose to short-oblong, scarlet, lustrous, $\frac{1}{2}'$ in diameter; calyx prominent, with an elongated narrow tube, and reflexed villose lobes bright red toward the base on the upper side; flesh thick, bright yellow, sweet and succulent; nutlets usually 3, or 2, $\frac{1}{4}'$ long, broad and flat, full and rounded at the ends, ridged on the back with a prominent rounded ridge, the ventral cavities broad and deep.

A tree, occasionally 30° high, with a tall trunk 10′–12′ in diameter, covered with dark brown scaly bark, stout spreading or ascending branches forming a broad rather open

Fig. 498

symmetrical head, stout zigzag glabrous red-brown or gray-brown lustrous branchlets armed with straight or slightly curved thick chestnut-brown spines usually about 2′ long, and winter-buds sometimes $\frac{1}{4}'$ in diameter.

Distribution. Rich forest glades, or the margins of woods, usually in low rich soil; eastern New York, near Albany, Albany County; western New York (Monroe and Livingston Counties); southern Ontario (La Salle on the Niagara River and near London); northwestern Ohio (Oak Harbor, Ottawa County); southern Michigan; common; Illinois (Calumet, Cook County, and Manley, Fulton County); southern Wisconsin (Waukesha, Waukesha County and near Madison, Dane County).

147. Cratægus illinoiensis Ashe.

Leaves broad-obovate to oval, rounded or rarely acute at the wide apex, broad-cuneate and entire at the base, coarsely and often doubly serrate above, with straight or incurved teeth tipped with minute deciduous glands, and sometimes slightly and irregularly divided toward the apex into short acute lobes, when they unfold covered below with a thick coat of hoary tomentum and pilose above, and when the flowers open about the 20th of May membranaceous, yellow-green, covered above with short pale hairs and pubescent below, and at maturity thick and firm in texture, dark green and glabrous on the upper surface, pale and pubescent on the lower surface, particularly on the stout midrib and 4–6 pairs of primary veins deeply impressed on the upper side, 2′–$2\frac{1}{2}'$ long, and $1\frac{1}{2}'$–2′ wide; petioles stout, slightly winged toward the apex, generally bright red below the middle after midsummer, and usually $\frac{1}{2}'$–$\frac{3}{4}'$ in length; leaves at the end of vigorous shoots usually elliptic, acute or acuminate, more coarsely dentate and more often lobed, sometimes decurrent nearly to the base of the stout petiole, 3′–4′ long, and $2\frac{1}{2}'$–3′ wide. **Flowers** about $\frac{5}{8}'$ in diameter, on slender slightly hairy pedicels, in broad compact villose corymbs; calyx-tube narrowly

obconic, coated with long matted pale hairs, the lobes broad, acuminate, very coarsely glandular-serrate with large stipitate bright red glands, glabrous on the outer surface except at the base, villose on the inner surface; stamens 10; anthers rose color; styles 2 or usually 3. **Fruit** ripening early in October and persistent on the branches until after the beginning of winter, on stout bright red pedicels, in few-fruited drooping villose clusters, globose, scarlet, lustrous, marked by occasional dark dots, more or less villose at the ends, $\frac{1}{2}'$ in diameter; calyx prominent, with a short villose tube, and spreading lobes gradually narrowed from a broad base, sparingly glandular-serrate or nearly entire, villose, mostly deciduous before the fruit ripens; flesh thin, yellow, dry and mealy; nutlets 2 or 3, $\frac{1}{4}'$ long, broad and thick, rounded at the ends, the ventral cavities broad and deep.

Fig. 499

A tree, rarely more than 18° high, with a trunk 4′–5′ in diameter, covered with thin close bark broken on the surface into pale plate-like scales, and divided into several long erect and spreading slender branches forming a wide open-topped head, and stout somewhat zigzag branchlets covered at first with scattered pale caducous hairs, bright orange-brown and lustrous during their first season, becoming dark brown in their second year and ultimately ashy gray, and armed with numerous slender straight or curved bright chestnut-brown shining spines $1\frac{1}{2}'$–3′ long.

Distribution. Open woods along the gravelly banks of small streams in Stark and Peoria Counties, Illinois; not common.

148. Cratægus integriloba Sarg.

Leaves broad-obovate, oval or rhombic, acute, gradually or abruptly narrowed below the middle, entire at the cuneate base, coarsely doubly serrate above with spreading glandular teeth, and irregularly divided into numerous short acute or acuminate lobes, coated in early spring with soft pale caducous hairs, nearly fully grown when the flowers open during the first week in June, and at maturity glabrous, thin and firm in texture, dark green and lustrous on the upper surface, pale yellow-green on the lower surface, $1\frac{1}{2}'$–2′ long, and 1′–$1\frac{1}{2}'$ wide, with a slender midrib often dark red at the base, and 4–6 pairs of slender primary veins deeply impressed on the upper side; petioles stout, more or less broadly winged toward the apex, at first puberulous, soon glabrous, often red on the lower side, $\frac{1}{2}'$–$\frac{3}{4}'$ in length; leaves at the end of vigorous shoots more coarsely serrate, more deeply lobed, often 3′ long and $2\frac{1}{2}'$ wide, with stout broadly winged petioles. **Flowers** $\frac{3}{4}'$ in diameter, on long slender villose pedicels, in broad open crowded villose corymbs; calyx-tube broadly obconic, coated toward the base with long matted white hairs and glabrous above, the lobes linear-

lanceolate, elongated, entire or very rarely furnished with occasional caducous glands; stamens 10; anthers large, rose color; styles 2 or 3, surrounded at base by a narrow ring of snow-white hairs. **Fruit** ripening at the end of September or early in October, on short stout pedicels, in drooping or erect many-fruited slightly villose clusters, subglobose, bright scarlet, lustrous, marked by large pale dots, $\frac{1}{3}'$–$\frac{1}{2}'$ in diameter; calyx enlarged, prominent, with elongated entire lobes, dark red on the upper side at base, much reflexed and persistent; flesh thin, yellow, sweet and pulpy; nutlets 2 or 3, about $\frac{1}{4}'$ long, thick and broad, rounded at the narrow ends, the ventral cavities broad and deep.

Fig. 500

A tree, occasionally 18°–20° high, with a straight erect trunk 6′–8′ in diameter, wide-spreading or erect branches forming an open irregular head, and stout nearly straight or occasionally slightly zigzag glabrous branchlets, lustrous and red-brown or orange-brown during their first summer and ultimately dull ashy gray, and armed with stout nearly straight bright chestnut-brown shining spines $1\frac{1}{2}'$–$2\frac{1}{2}'$ long and often pointed toward the base of the branch.

Distribution. Low limestone ridges, Province of Quebec, south of the St. Lawrence River near the Lachine Rapids, and at Caughnawaga, Rockfield, and Adirondack Junction.

149. Cratægus macracantha Koehne.

Leaves broad-obovate to elliptic or oval, acute or rounded and sometimes short-pointed at apex, gradually or abruptly narrowed and cuneate at the entire base, coarsely and often doubly serrate above with straight or incurved gland-tipped teeth, and usually divided above the middle into numerous short acute or acuminate lobes, when they unfold often bright red and coated on the upper surface with soft pale hairs, more than half grown when the flowers open late in May and then dull yellow-green, nearly glabrous on the upper surface and pale and puberulous on the lower surface, and at maturity coriaceous, dark green and glabrous above, frequently puberulous below on the midrib, and on the 4–6 pairs of slender primary veins extending obliquely to the point of the lobes and deeply impressed on the upper side, usually $2'$–$2\frac{1}{2}'$ long and $1\frac{1}{2}'$–$2'$ wide; petioles stout, more or less winged above, frequently bright red after midsummer and usually about $\frac{1}{2}'$ in length; leaves at the end of vigorous shoots often broad and rounded at base, coarsely dentate, 3′–4′ long, and $2\frac{1}{2}'$–$3'$ wide. **Flowers** about $\frac{3}{4}'$ in diameter, on long slender hairy pedicels, in broad more or less villose corymbs; calyx-tube narrowly obconic, more or less villose or nearly glabrous, the lobes long, narrow, acuminate, glandular with minute dark glands, glabrous on the outer surface, slightly villose on the inner surface; stamens usually 10, occasionally 8–12; anthers pale yellow; styles 2–3, surrounded at the base by a broad ring of hoary tomentum.

Fruit ripening at the end of September and often remaining on the branches for several weeks longer, on erect slender pedicels, in broad open many-fruited usually slightly villose clusters, globose, often hairy at the ends until nearly ripe, crimson, very lustrous, $\frac{1}{4}'$–$\frac{1}{3}'$ in diameter; calyx large and conspicuous, the lobes coarsely serrate, reflexed and persistent; flesh thin, dark yellow, dry and mealy; nutlets 2 or 3, about $\frac{1}{4}'$ long and wide, broad and rounded at the ends, the ventral cavities deep and irregular.

A tree, occasionally 15° high, with a tall stem 5′–6′ in diameter, covered with pale close bark, stout wide-spreading branches forming an open rather irregular head, and stout

Fig. 501

slightly zigzag glabrous light chestnut-brown very lustrous branchlets, becoming dull reddish brown in their second year, and armed with numerous slender usually curved very sharp bright chestnut-brown shining spines $2\frac{1}{2}'$–4′ long.

Distribution. Western Vermont (near Middlebury, Addison County); central and western New York; southern Ontario (near Toronto); northeastern Illinois (Barrington, Cook County); and eastern Pennsylvania (Bucks and Northampton Counties).

XIX. DOUGLASIANÆ.

CONSPECTUS OF THE ARBORESCENT SPECIES.

Leaves subcoriaceous, lustrous above, obovate to broad-ovate, coarsely serrate, usually lobed; stamens 5–20, normally 10; spines numerous, short and stout.
150. C. Douglasii.

Leaves thinner, dull bluish green, lanceolate to oblong-obovate or elliptic, acute at the ends, finely serrate, not lobed; stamens 10–20; spines few, long and slender or wanting.
151. C. rivularis.

150. Cratægus Douglasii Lindl.

Leaves broad-obovate to ovate, gradually narrowed below to the cuneate entire base, coarsely serrate above with minute glandular teeth, and often incisely lobed toward the acute apex, nearly fully grown and coated above and on the midrib and veins below with short pale hairs when the flowers open in May, and at maturity thin, glabrous, dark green and lustrous above, paler below, 1′–2′ long, and $\frac{1}{2}'$–$1\frac{1}{2}'$ wide; petioles slender, wing-margined above, sparingly glandular, villose early in the season, becoming glabrous, $\frac{1}{2}'$–$\frac{3}{4}'$ in length; leaves at the end of vigorous shoots broad-obovate, incisely lobed at the broad apex, often

deeply divided into lateral lobes, or occasionally 3-lobed, 3′–4′ long, and 2′–3′ wide. **Flowers** ½′–$\frac{7}{12}$′ in diameter, on long slender glabrous pedicels, in broad glabrous corymbs, with linear caducous bracts and bractlets; calyx-tube broadly obconic, glabrous, the lobes gradually narrowed from a broad base, entire or occasionally minutely dentate, acute and bright red at apex, glabrous on the outer surface, villose on the inner surface; stamens 10 or rarely 5 by abortion; anthers small, pale rose color; styles 2–5, surrounded at base by tufts of long pale hairs. **Fruit** ripening and falling in August and September, on slender pedicels, in compact, many-fruited drooping clusters, short-oblong, truncate at apex, black and lustrous, very rarely chestnut-colored (f. *badia* Sarg.), about ½′ long; calyx persistent; flesh thick, sweet and succulent, light yellow; nutlets usually 5, about ¼′ long, narrowed at base, broad and rounded at apex, ridged on the back with a narrow ridge, the ventral cavities irregular, small and shallow.

A tree, 30°–40° high, with a long trunk 18′–20′ in diameter, stout branches spreading and ascending and forming a compact round-topped head, and slender rigid glabrous bright red

Fig. 502

or orange-red lustrous branchlets unarmed, or armed with straight or slightly curved blunt or rarely acute bright red ultimately ashy gray spines ⅓′–1′ long; often shrubby and spreading into wide thickets.

Distribution. Banks of mountain streams; valley of the Parsnip River, British Columbia, through Washington and Oregon to the valley of the Pitt River, California, and eastward in the United States through the northern Rocky Mountain region to the Bighorn Mountains, Wyoming; passing into the var. *Suksdorfii* Sarg. differing in its 20 stamens, fruit not more than ⅓′ in diameter, usually in few-fruited clusters and ripening from the 1st of July to the middle of August. A shrub with numerous stems occasionally 25° high; banks of the Columbia River and borders of bottom-lands, western Klickitat County, Washington.

151. Cratægus rivularis Nutt.

Leaves lanceolate to narrowly oblong-obovate or elliptic, acute, acuminate or abruptly acuminate at apex, gradually narrowed and concave-cuneate at the long entire base, and very finely crenately serrate above with glandular teeth, when they unfold tinged with red, villose above and coated below with matted pale hairs, more than half grown when the flowers open late in May and then hairy on the midrib and veins above and pale and glabrous below, and at maturity thin, dull bluish green and smooth on the upper surface, pale yellow-green on the lower surface, about 2′ long and ¾′ wide, with a slender yellow midrib and 3 or 4 pairs of thin obscure primary veins; petioles slender, slightly winged at apex, at

first villose, becoming glabrous and rose-colored below the middle, and about $\frac{1}{2}'$ in length; leaves at the end of vigorous shoots often rhombic, coarsely serrate, often slightly incisely lobed, coriaceous, 3′ long, and 2′ wide, with a stout broadly winged petiole. **Flowers** $\frac{1}{2}'$ in diameter, on long slender pedicels, in rather compact glabrous corymbs; calyx-tube broadly obconic, glabrous, the lobes linear, entire or glandular with minute caducous glands, glabrous on the outer surface, sparingly villose on the inner surface, often tinged with red; stamens 10–20; anthers pale rose color. **Fruit** ripening in September, on long pedicels, in drooping few-fruited clusters, short-oblong, full and rounded at the ends, dark crimson and marked by many large white dots when fully grown, becoming black and lustrous at maturity, $\frac{1}{3}'$–$\frac{1}{2}'$ long; calyx slightly enlarged, persistent, with elongated closely appressed entire lobes slightly villose and dark red on the upper side below the middle; flesh thin, yellow, dry and mealy; nutlets 3–5, $\frac{1}{4}'$ long, narrowed and rounded at the ends, slightly ridged on the back, the ventral cavities broad and shallow.

Fig. 503

A tree, occasionally 20° high, with a slender trunk covered with dark brown scaly bark, erect branches forming a narrow rather open head, and slender bright red-brown lustrous branchlets marked by numerous pale lenticels, and unarmed or armed with straight slender spines usually about 1′ long.

Distribution. Banks of mountain streams, often forming thickets; southeastern Idaho, (Pocatello and Inkom, Bannock County); northeastern Nevada (Lee, Elk County) to southwestern Wyoming, eastern Utah, southwestern Colorado, and northern New Mexico.

XX. ANOMALÆ.

CONSPECTUS OF THE ARBORESCENT SPECIES.

Stamens 5–15; corymbs glabrous; leaves scabrate above.	152. **C. scabrida** (A).
Stamens 20; corymbs villose; leaves glabrous above.	153. **C. virilis** (A).

152. Cratægus scabrida Sarg.

Leaves oval to obovate, acuminate, gradually narrowed from near the middle to the acuminate base, irregularly glandular-serrate nearly to the base, and divided above into numerous short spreading lobes coated above when the flowers open at the end of May with short pale hairs, and at maturity thick and firm, dark green and scabrate on the upper surface, pale yellow-green and glabrous on the lower surface, 2′–3′ long, and $1\frac{1}{2}'$–2′ wide; petioles slender, occasionally glandular, often slightly winged toward the apex, $\frac{1}{2}'$–$1\frac{1}{4}'$ in length. **Flowers** $\frac{3}{4}'$ in diameter, on slender glabrous pedicels, in broad glabrous corymbs;

calyx narrowly obconic, glabrous, the lobes linear-lanceolate, long-acuminate, finely glandular-serrate; stamens 5–15; anthers small, pale yellow; styles 3, surrounded at base by a thick tuft of pale tomentum. **Fruit** in loose drooping clusters, subglobose, scarlet, $\frac{1}{2}'$ in diameter, only the base of the reflexed calyx-lobes persistent on the ripe fruit; flesh yellow, thick, dry and mealy; nutlets 3, rounded and prominently ridged on the back, $\frac{1}{3}'$ long, the ventral depression wide, shallow, irregular, often obscure.

Fig. 504

A tree, 15°–20° high, with a trunk 6′ to 8′ in diameter, spreading horizontal branches forming a broad round-topped head, and stout slightly zigzag glabrous branchlets marked by oblong pale lenticels, dark chestnut-brown during their first season, becoming ashy gray during their second year, and armed with slender straight or curved spines $1\frac{1}{2}'$–2′ in length; or often a tall intricately branched shrub.

Distribution. Valley of the St. Lawrence River, near Montreal, Province of Quebec to the neighborhood of Toronto, southern Ontario; northern and western Vermont; southern New Hampshire (slopes of Little Monadnock Mountain); western Massachusetts, and western New York.

153. Cratægus virilis Sarg.

Leaves oblong-obovate, acuminate or rounded and short-pointed at apex, concave-cuneate and gradually narrowed to the acute entire base, finely doubly serrate above with straight glandular teeth, and slightly divided above the middle into 3 or 4 pairs of small acuminate lobes, nearly fully grown when the flowers open during the first week of June and then thin, yellow-green, smooth and slightly hairy above and pale bluish green and covered below with short white hairs most abundant on the stout yellow midrib and slender primary veins, and at maturity thin, glabrous, dark green and lustrous on the upper surface, slightly villose on the lower surface, $2\frac{1}{2}'$–3′ long, and $1\frac{3}{4}'$–2′ wide; petioles stout, wing-margined often to below the middle, slightly villose on the upper side early in the season, soon glabrous, $\frac{3}{5}'$–1′ in length; leaves at the end of vigorous shoots subcoriaceous, oval to rhombic, acuminate, often long-pointed, 3′–4′ long, and 2′–$2\frac{1}{2}'$ wide, with a rose-colored midrib and stout broadly winged petiole. **Flowers** about $\frac{1}{2}'$ in diameter, on slender villose pedicels, in broad lax hairy usually 15–18-flowered corymbs; calyx-tube narrowly obconic, coated with long matted pale hairs, the lobes slender, acuminate, irregularly glandular-serrate near the middle, glabrous on the outer, slightly villose on the inner surface, reflexed after anthesis; stamens 20, anthers slightly tinged with pink, styles 4 or 5. **Fruit** ripening from the middle to the end of September, on puberulous reddish pedicels, in erect or spreading few-fruited clusters, short-oblong to ovoid, scarlet, lustrous, pubescent especially near the rounded ends, marked by small dark dots, $\frac{2}{3}'$–$\frac{1}{2}'$ long, and about $1\frac{1}{3}'$ in

diameter; calyx prominent, with long slender spreading and reflexed coarsely serrate usually persistent lobes villose on the upper surface; flesh thin, yellow, rather dry; nutlets 4 or 5, acute at the ends, prominently ridged on the back with a broad deeply grooved ridge, generally furnished with obscure ventral depressions, about $\frac{1}{4}'$ long.

A tree, sometimes 30° high, with a short trunk frequently 1° in diameter, covered with dark scaly bark, stout ascending branches forming a narrow open irregular head, and slen-

Fig. 505

der nearly straight glabrous branchlets dark orange-green when they first appear, becoming light chestnut-brown, lustrous and marked by pale lenticels in their first season, and armed with stout straight or slightly curved bright chestnut-brown shining spines $1\frac{1}{2}'$–$2'$ in length, long persistent and becoming branched on old stems.

Distribution. Fence rows, southwest of the village of Weston, near Toronto, Ontario.

8. COWANIA D. Don.

Trees or shrubs with scaly bark and rigid terete branchlets. Leaves alternate, simple, lobed or rarely linear, subcoriaceous, straight-veined, glandular-dotted on the upper surface, tardily deciduous or persistent, short-petiolate; stipules adnate to the base of the petiole. Flowers solitary at the end of short lateral branches; calyx-tube turbinate, persistent, the limb 5-lobed, deciduous, the lobes imbricated in the bud; disk thin, adnate to the tube of the calyx, its margins thickened; petals 5, obovate, spreading, larger than the calyx-lobes; stamens numerous, inserted in two rows in the mouth of the calyx-tube, incurved, persistent; anthers peltate, eglandular, 2-celled, opening longitudinally; carpels 5–12, inserted in the bottom of the calyx-tube, free, villose, 1-celled; style short, villose, stigma simple, filiform; ovule solitary, ascending: raphe linear, dorsal; micropyle inferior. Fruit composed of 5–12 1-celled ellipsoidal akenes, included in the tube of the calyx, and tipped with the much elongated persistent styles covered with long white hairs; seed filling the cavity of the carpel, linear-obovoid, erect; hilum basal, minute; testa membranaceous; albumen thin; cotyledons oblong, radicle inferior.

Cowania is confined to the dry interior region of the United States and Mexico. Three species can be distinguished; of these the type of the genus, *Cowania mexicana* D. Don, sometimes attains the size and habit of a small tree. The genus was named in honor of James Cowan (died 1823), an English merchant who traveled in Mexico and Peru and sent plants to England.

1. Cowania mexicana D. Don.

Cowania Stansburiana Torr.
Cowania Davidsonii Rydb.

Leaves short-petioled, cuneate, revolute on the margins, 3 or rarely 5-lobed above the middle, the lobes linear, entire or slightly divided, coriaceous, dark green above, hoary-

tomentose below, $\frac{1}{3}'$–$\frac{1}{2}'$ long, tardily deciduous or persistent until spring; leaves on vigorous shoots and on flower-bearing branchlets occasionally linear and entire; stipules ciliate on the margins, united below and adnate to the short persistent petiole, free above the middle and acute at apex, persistent and becoming woody on the flower-bearing branchlets. **Flowers** appearing in early spring, 1′ in diameter; calyx-tube more or less tomentose and covered with rigid glandular hairs, the lobes rounded at apex, hoary-tomentose; petals broad-obovate, rounded and emarginate at apex, cuneate and short-stipitate below, pale yellow or nearly white. **Fruit** ripening in October, about $\frac{1}{4}'$ long and as long as the calyx-tube, the elongated style often 2′ in length.

A tree, occasionally 20°–25° high, with a tall trunk 6′–8′ in diameter, short spreading branches forming a narrow head, and slender rigid branchlets red and glandular during

Fig. 506

their first season, becoming dark reddish brown and glabrous the following year. **Bark** of the trunk pale gray, separating freely into long narrow thin loosely attached plates; more often a shrub with spreading stems often only a few feet tall.

Distribution. Dry rocky slopes and mesas, usually at altitudes between 6000° and 8000°; northern Utah and central Nevada, through Arizona and western New Mexico to northern Mexico; common and probably of its largest size near the southern rim of the Grand Cañon, and on the lower slopes of the San Francisco Mountains, Arizona.

9. CERCOCARPUS H. B. K. Mountain Mahogany.

Trees or shrubs, with scaly bark, rigid terete branches, short lateral spur-like branchlets conspicuously roughened for many years by the crowded narrow horizontal scars of fallen leaves, minute buds, the scales of the inner rows accrescent on the growing shoots and often colored. Leaves alternate, simple, entire or serrate, coriaceous, straight-veined, short-petiolate, persistent; stipules minute, adnate to the base of the petiole, deciduous. Flowers axillary on the short lateral branchlets, sessile or short-pedicellate, solitary or fascicled, the pedicels sometimes lengthening before the fruit ripens; calyx-tube long, cylindric, abruptly expanded at apex into a cup-shaped, 5-lobed deciduous limb, the lobes imbricated in the bud; disk thin, slightly glandular, adnate to the tube of the calyx; petals 0; stamens 15–30, in 2 or 3 rows; filaments incurved in the bud, free, short, terete; anthers oblong, pubescent or tomentose, distinct and united by a broad connective; ovary composed of a single carpel inserted in the bottom and included in the tube of the calyx, acute, terete, smooth, striate or sulcate, sericeous, rarely bicarpellate; style terminal, filiform, villose or glabrate, crowned with a minute obtuse stigma; ovule solitary, subbasilar, ascending; raphe dorsal; micropyle

inferior. Fruit a linear-oblong coriaceous slightly ridged angled or sulcate akene, included in the persistent tube of the spindle-shaped calyx more or less deeply cleft at the apex, and tipped with the elongated persistent style clothed with long white hairs. Seed solitary, linear, acute, erect; hilum conspicuous lateral above the oblique base; testa membranaceous; embryo filling the cavity of the seed; cotyledons ovate-oblong, elongated, fleshy; radicle inferior.

Cercocarpus is confined to the dry interior and mountainous regions of North America. Twenty-one species, often of doubtful value, have been distinguished; seventeen are credited to the territory of the United States and the others to Mexico. The heavy hard brittle wood of all the species makes valuable fuel and is occasionally used in the manufacture of small articles for domestic and industrial use.

The generic name, from κέρκος and καρπός, refers to the peculiar long-tailed fruit.

CONSPECTUS OF THE ARBORESCENT SPECIES OF THE UNITED STATES.

Flowers usually in many-flowered clusters.

Leaves coarsely serrate above the middle.

Leaves oval to semiorbicular or obovate, hoary-tomentose below, sinuate-dentate; flowers short-pedicellate. **1. C. Traskiæ.**

Leaves oval to slightly obovate, green and glabrous below, denticulate with broad apiculate teeth; flowers long-pedicellate. **2. C. alnifolius.**

Leaves finely serrate above the middle, obovate to oval, pale and villose below; flowers short-pedicellate. **3. C. betuloides.**

Flowers solitary or rarely in 2 or 3-flowered clusters, nearly sessile.

Leaves narrow-lanceolate, lance-elliptic or oblanceolate, acute at the ends, entire, pale or rufous below. **4. C. ledifolius.**

Leaves oblong-obovate to narrow-elliptic, entire or slightly dentate below the apex, villose-pubescent. **5. C. paucidentatus.**

2. Cercocarpus Traskiæ Eastw.

Leaves oval to semiorbicular or obovate, rounded or acute at apex, cuneate, rounded or occasionally somewhat cordate at the narrow base, revolute on the margins, entire below,

Fig. 507

coarsely sinuate-dentate above the middle with slender teeth tipped with minute dark glands, when they unfold covered above with soft pale hairs and below with thick hoary tomentum, and at maturity coriaceous, dark green, lustrous and villose or nearly glabrous

on the upper surface, pale-tomentose on the lower surface, 1½′–2′ long, and 1′–1½′ wide, with prominent primary veins running obliquely to the point of the teeth, and, like the stout midrib, conspicuously impressed on the upper side; petioles stout, hoary-tomentose, about ¼′ in length; stipules acuminate, scarious, covered on the margins with long white hairs, ¼′ long. **Flowers** appearing early in March, nearly sessile, in 1–5 usually 4 or 5-flowered clusters, hoary-tomentose, ½′–¾′ long; calyx broad, glabrous on the inner surface; anthers tomentose. **Fruit:** mature calyx, light reddish brown, villose-pubescent, deeply cleft at apex, ½′ long; akene slightly ridged on the back, ⅓′ in length, covered with long lustrous white hairs; style 1½′–2′ in length.

A tree, occasionally 25° high, with a trunk often inclining, usually much contorted, 2′–10′ in diameter and 6°–8° long, stout wide-spreading branches, and stout branchlets, hoary-tomentose when they first appear, marked by numerous small scattered lenticels, bright reddish brown during two or three years, ultimately dark gray-brown and conspicuously roughened by the enlarged ring-like leaf-scars. **Bark** light gray, sometimes slightly broken by shallow fissures and marked by irregular cream-colored blotches.

Distribution. Steep sides of a deep narrow arroyo on the south coast of Santa Catalina Island, California.

2. Cercocarpus alnifolius Rydb.

Cercocarpus parvifolius Sarg., in part, not Nutt.

Leaves occasionally persistent until late in the spring, oval to slightly obovate, rounded or rarely acute at apex, rounded or cuneate at base, and coarsely serrate above the middle with broad apiculate teeth, when they unfold covered above with soft white hairs and pale and

Fig. 508

villose on the midrib and veins below, and at maturity thick, glabrous, dark green and lustrous on the upper surface, pale and yellow-green on the lower surface, 1½′–2½′ long, and 1′–2′ wide, with a stout midrib and 6–7 pairs of slender prominent veins; petioles stout, sparingly villose early in the season, soon glabrous, ⅓′–½′ long; stipules ovate, abruptly long-pointed, covered with silky white hairs. **Flowers** on slender hairy pedicels ⅓′–½′ long, in 2–15 usually 4 or 5-flowered clusters; calyx-tube villose, about $\frac{5}{12}$′ long, the limb villose on the outer surface, ¼′ broad. **Fruit:** mature calyx-tube many-nerved, deeply cleft at apex, villose-pubescent, dark chestnut-brown, ⅓′–½′ long; akene covered with long silky hairs; style 2′–2½′ in length.

A tree, 12°–20° high, with one or two or three trunks, occasionally 8′ in diameter, small

erect and spreading branches forming a narrow round-topped head, and slender branchlets green and sparingly villose when they first appear, soon becoming glabrous, and in their second year chestnut-brown and lustrous and marked by minute pale lenticels. **Bark** about $\frac{1}{4}'$ thick, dark reddish brown, fissured and divided into small closely appressed scales.

Distribution. Hillsides, Descanso Cañon, about a mile and a half up the coast west of Avalon, Santa Catalina Island, and on Santa Cruz Island, California.

3. Cercocarpus betuloides Nutt.

Cercocarpus parvifolius var. *betuloides* Sarg.

Leaves obovate to oval, acute or rounded at apex, cuneate at base, finely serrate above the middle with straight or incurved glandular teeth, dark green on the upper surface, pale and villose-pubescent or tomentose sometimes becoming nearly glabrous on the lower

Fig. 509

surface, $1'$–$1\frac{1}{4}'$ long, and $\frac{1}{3}'$–$\frac{1}{2}'$ wide, with a thin midrib, and 5–8 pairs of slender primary veins more or less deeply impressed on the upper side of the leaf; petioles densely villose, often becoming glabrous, about $\frac{1}{4}'$ in length; stipules scarious, acuminate. **Flowers** nearly sessile, in 1–3-flowered clusters; calyx-tube densely villose, about $\frac{1}{3}'$ long, the limb turbinate, villose on the outer surface, glabrous on the inner surface, $\frac{1}{4}'$ wide. **Fruit** on slender slightly villose pedicels $\frac{1}{4}'$–$\frac{1}{3}'$ in length; mature calyx-tube often slightly gibbous, deeply cleft at apex, light chestnut-brown, sparingly villose, $\frac{1}{12}'$ in diameter; akene covered with stiff spreading hairs; style $2'$–$3'$ in length.

A tree, occasionally 25° high, with a single trunk, small ascending and spreading branches forming an open irregular head, and slender red-brown branchlets covered when they first appear with loose pubescence, soon becoming glabrous; more often a tall or low shrub with several stems. **Bark** smooth, separating into thin deciduous scales.

Distribution. Common and widely distributed over the California coast ranges from Siskiyou County to the Santa Monica and San Bernardino Mountains.

4. Cercocarpus ledifolius Nutt.

Leaves narrow-lanceolate, lance-elliptic or oblanceolate, acute at the ends, apiculate, entire with thick revolute margins, coriaceous, reticulate-veined, puberulous while young, and at maturity dark green, lustrous and glabrous on the upper surface and pale or rufous and tomentulose on the lower surface, resinous, $\frac{1}{2}'$–$1'$ long, and $\frac{1}{3}'$–$\frac{2}{3}'$ wide, with a broad

thick midrib deeply grooved on the upper side, and obscure primary veins; persistent until the end of their second summer; petioles broad, about $\frac{1}{8}'$ in length; stipules nearly triangular. **Flowers** solitary, sessile in the axils of the clustered leaves, $\frac{2}{3}'$ long; calyx hoary-tomentose. **Fruit:** mature calyx-tube almost $\frac{1}{2}'$ long, nearly cylindric, rather larger above than below, 10-ribbed, obscurely 10-angled, slightly cleft at apex, hoary-tomentose; akene pointed at the ends, obscurely angled, chestnut-brown, $\frac{1}{4}'$ long, covered with long pale or tawny hairs; style 2′–3′ in length, generally contracted by 1 or 2 partial corkscrew twists.

A resinous slightly aromatic tree, occasionally 40° high, with a short trunk sometimes $2\frac{1}{2}°$ in diameter, stout spreading usually contorted branches forming a round compact head, and red-brown branchlets coated at first with pale pubescence, soon becoming glabrous, frequently covered with a glaucous bloom, silver gray or dark brown in their second year, and for many years marked by the conspicuous elevated leaf-scars. **Bark** red-brown, divided by deep broad furrows, and broken on the surface into thin persistent plate-like

Fig. 510

scales, becoming on old trunks 1′ thick. **Wood** bright clear red or rich dark brown, with thin yellow sapwood of 15–20 layers of annual growth.

Distribution. Dry gravelly arid slopes at altitudes of 5000°–9000°; mountain ranges of the interior region of the United States from eastern Washington and Oregon, to lower Green and Snake River valleys, Wyoming, and through Utah and Nevada to southwestern Colorado; in California to the eastern slope of the Sierra Nevada, the northern slopes of the San Bernardino Mountains, on Mt. Pinos, San Diego County, and on the northern coast mountains (Snow Mountain to Scott Mountain, *Jepson*).

5. Cercocarpus paucidentatus Britt.

Cercocarpus eximius Rydb.

Leaves oblong-obovate to narrow-elliptic, acute or rounded and often apiculate at apex, gradually narrowed from above the middle and acute at base, their margins revolute, often undulate, and entire or dentate toward the apex with few small straight or incurved apiculate teeth, when they unfold coated with hoary tomentum, and at maturity thick, gray-green and covered with soft white hairs or nearly glabrous on the upper surface, pale and tomentulose on the lower surface, $\frac{1}{2}'$–1′ long and $\frac{1}{4}'$–$\frac{1}{2}'$ wide, with a thin prominent midrib and primary veins; petioles stout, tomentose, ultimately pubescent or nearly glabrous, $\frac{1}{16}'$–$\frac{1}{5}'$ in length; stipules linear-lanceolate, tomentose, about half as long as the petioles. **Flowers** appearing from March to May and often again in August, nearly sessile, solitary,

in pairs or rarely in 3-flowered clusters in the axils of the crowded leaves; calyx-tube slender, $\frac{1}{6}'$–$\frac{1}{4}'$ long, thickly covered on the outer surface, like the short rounded lobes, with long white hairs. **Fruit**: mature calyx-tube short-stalked, light red-brown, villose, deeply cleft at apex, about $\frac{1}{4}'$ long; akene nearly terete, covered with long white hairs; style $1'$–$1\frac{1}{2}'$ in length.

A tree, 20°–25° high, with a long straight trunk sometimes 6′–8′ in diameter, erect rigid branches forming a narrow open or irregular head, and slender bright red-brown lustrous branchlets marked irregularly by large scattered pale lenticels, covered at first with a thick coat of hoary tomentum, villose or pubescent for two or three years and ultimately ashy

Fig. 511

gray or gray tinged with red, the spur-like lateral branchlets much roughened by the ring-like scars of fallen leaves. **Bark** about $\frac{1}{8}'$ thick, divided by shallow fissures and broken on the surface into small light red-brown scales.

Distribution. In forests of Pines and Oaks usually at altitudes of about 5000°, on the dry ridges of the mountains of western Texas, and of southern New Mexico and Arizona; in Arizona ranging northward to Oak Creek Cañon, near Flagstaff, Coconino County (*P. Lowell*); and southward over the mountains of northern Mexico.

10. PRUNUS B. & H. Plum and Cherry

Trees or shrubs, with bitter astringent properties, slender branchlets, marked by the usually small elevated horizontal leaf-scars with 2 or 3 fibro-vascular bundle-scars, and small scaly buds, their scales imbricated in many rows, those of the inner rows accrescent and often colored. Leaves convolute or conduplicate in the bud, alternate, simple, usually serrate, petiolate, deciduous or persistent; stipules free from the petiole, usually lanceolate and glandular, often minute, early deciduous. Flowers in axillary umbels or corymbs, or in terminal or axillary racemes, appearing from separate buds before, with, or later than the leaves, or on leafy branches; calyx 5-lobed, the lobes imbricated in the bud; disk thin, adnate to the calyx-tube, glandular, often colored; petals 5, white, deciduous; stamens usually 15–20, inserted with the petals in 3 rows, those of the outer row 10, opposite the petals, those of the next row alternate with them and with those of the inner row, sometimes 30 in 3 rows; filaments filiform, free, incurved in the bud; anthers oval, attached on the back; ovary inserted in the bottom of the calyx-tube, 1-celled; style terminal, dilated at apex into a truncate stigma; ovules 2, suspended; raphe ventral; the micropyle superior. Fruit a 1-seeded drupe; flesh thick and pulpy or dry and coriaceous; stone bony, smooth, rugose, or

pitted, compressed, indehiscent. Seed filling the cavity of the nut, suspended; seed-coat thin, membranaceous, pale brown; cotyledons thick and fleshy; radicle superior.

Prunus with about one hundred and twenty species is generally distributed over the temperate regions of the northern hemisphere, and is abundant in North America, eastern Asia, western and central Asia and central Europe, ranging southward in the New World into tropical America, and to southern Asia in the Old World. Of the twenty-five or thirty species which occur in the United States, twenty-two are arborescent in habit. Several of the species bear fruits which are important articles of human food; many contain in the seeds and leaves hydrocyanic acid, to which is due their peculiar odor, and the fruit of some of the species is used to flavor cordials. The wood of Prunus is close-grained, solid, and durable, and a few of the species are important timber-trees.

Prunus is the classical name of the Plum-tree.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT SPECIES.

Flowers in sessile axillary umbels; fruit usually slightly 2-lobed by a ventral groove, generally more than $\frac{1}{2}'$ in diameter, red to nearly black or yellow, often covered with a glaucous bloom. PRUNOPHORA. PLUMS.

Leaves convolute in the bud, their petioles usually without glands.

Leaves broad-ovate to orbicular; fruit often 1′ or more in diameter, red or yellow, nearly destitute of bloom. **1. P. subcordata** (G).

Leaves ovate-lanceolate to oblong or obovate; fruit $\frac{1}{2}'$ in diameter or less, blue, nearly black, red or yellow, covered with a glaucous bloom. **2. P. umbellata** (C).

Leaves conduplicate in the bud.

Leaves dull dark green, usually abruptly pointed at apex.

Fruit red, rarely yellow, or blue in one form of *2* and *5;* leaves oblong to obovate; stone of the fruit compressed.

Leaves crennate-serrate, their petioles biglandular; calyx-lobes glandular. **3. P. nigra** (A).

Leaves sharply serrate with slender often apiculate teeth.

Leaves narrowed and usually cuneate at base.

Leaves glabrous or villose on the midrib below; petioles and calyx-lobes usually without glands. **4. P. americana** (A, C, F).

Leaves pubescent below; fruit covered with a thick glaucous bloom.

Petioles eglandular or with a single gland near the apex; pedicel of the flower glabrous; calyx-tube puberulous; stone of the fruit rounded at base. **5. P. lanata** (A, C).

Petioles glandular near the apex with 1–3 prominent glands; pedicel of the flower furnished near the apex, like the glabrous calyx-tube, with long white hairs; stone of the fruit pointed at base. **6. P. tenuifolia** (C).

Leaves usually broad and rounded at base, ovate to elliptic or obovate, conspicuously reticulate-venulose; petioles glandular. **7. P. mexicana** (C).

Fruit purple, covered with a glaucous bloom; leaves lanceolate to oblong-ovate; petioles and calyx-lobes without glands; stone of the fruit turgid. **8. P. alleghaniensis** (A).

Leaves thin and lustrous, acute or acuminate, narrowed at base; petioles usually glandular; fruit red or yellow, the stone turgid.

Calyx-lobes glandular.

Leaves oblong-obovate to oblong-oval or rarely oblong-lanceolate. **9. P. hortulana** (A).

Leaves elliptic to lanceolate. **10. P. Munsoniana** (A, C).

Calyx-lobes without glands; leaves lanceolate to oblong-lanceolate. **11. P. angustifolia** (A, C).

Flowers in axillary umbels or corymbs; fruit bright red and lustrous, ½′ in diameter or less; leaves conduplicate in the bud. MAHALEB. BIRD CHERRIES.

Leaves oblong-lanceolate, acuminate or rarely acute at apex.

12. **P. pennsylvanica** (A, B, F).

Leaves oblong-obovate to oblanceolate, usually obtuse, occasionally acute at apex.

13. **P. emarginata** (B, F, G).

Flowers in terminal racemes on leafy branches of the year; fruit globose, red or rarely yellow; leaves conduplicate in the bud. PADUS. WILD CHERRIES.

Calyx-lobes deciduous from the fruit; leaves oblong-oval or obovate, abruptly pointed, cuneate, rounded or in one form cordate at base. 14. **P. virginiana** (A, B, F, G).

Calyx-lobes persistent on the fruit.

Petioles biglandular near the apex.

Leaves oblong to oblong-lanceolate, acuminate, glabrous, or rarely pubescent on the midrib below. 15. **P. serotina** (A, C).

Leaves oval, broad-ovate or rarely obovate, acute, short-pointed or rounded at apex, villose-pubescent below. 16. **P. alabamensis** (C).

Leaves obovate, oval or elliptic, short-pointed or rounded at apex, covered below with rufous hairs. 17. **P. australis** (C).

Petioles without glands; leaves elliptic to ovate or slightly obovate, acute, rounded or abruptly short-pointed at apex, in one form rusty pubescent on the midrib below. 18. **P. virens** (E, F, H).

Flowers in racemes from the axils of persistent leaves of the previous year; fruit globose or slightly three-lobed; leaves conduplicate in the bud. LAUROCERASUS. CHERRY LAURELS.

Calyx-lobes rounded, undulate on the margins; leaves oblong-lanceolate, acuminate, entire or rarely remotely spinulose-serrate; fruit black, the stone broad-ovoid, acute, cylindric. 19. **P. caroliniana** (C).

Calyx-lobes acute, minute.

Leaves elliptic to oblong-ovate, entire; fruit orange-brown, the stone subglobose. 20. **P. myrtifolia** (D).

Leaves ovate to ovate-lanceolate, acute, rounded or emarginate at apex, conspicuously spinulose-dentate; fruit red, becoming purple or nearly black, the stone ovoid, short-pointed. 21. **P. ilicifolia** (G).

Leaves ovate to lanceolate, acuminate or abruptly short-pointed at apex, usually entire; fruit dark purple or nearly black, the stone ovoid to obovoid, short-pointed. 22. **P. Lyonii** (G).

1. Prunus subcordata Benth. Wild Plum.

Leaves broad-ovate or orbicular, usually cordate, sometimes truncate or rarely cuneate at base, and sharply often doubly serrate, when they unfold puberulous on the upper surface and pubescent on the lower surface, and at maturity glabrous, or puberulous below, slightly coriaceous, dark green above and pale below, 1′–3′ long and ½′–2′ wide, with a broad midrib and conspicuous veins; northward turning brilliant scarlet and orange or red and yellow in the autumn before falling; petioles slender, usually eglandular, ½′–¾′ in length; stipules lanceolate, acute, glandular-serrate. **Flowers** appearing before the leaves in March and April, ⅔′ in diameter, on slender glabrous or pubescent pedicels ¼′–½′ long, in 2–4-flowered umbels; calyx-tube campanulate, glabrous or puberulous, the lobes oblong-obovate, rounded at apex, pubescent on the outer surface, more or less clothed with pale hairs on the inner surface, half as long as the obovate white petals rounded above and narrowed below into a short claw. **Fruit** ripening in August and September, on stout pedicels ½′–⅔′ long, short-oblong, ½′–1¼′ long, with dark red or sometimes bright yellow skin, and more or less subacid flesh; stone flattened or turgid, acute at the ends, ⅓′–1′ long, narrowly wing-margined on the ventral suture, conspicuously grooved on the dorsal suture.

A tree, 20°–25° high, with a trunk sometimes a foot in diameter, dividing 6°–8° from the

ground into stout almost horizontal branches, and glabrous or pubescent bright red more or less spinescent branchlets marked by occasional minute pale lenticels, becoming darker red or purple in their second year, and ultimately dark brown or ashy gray; or often a bush, with stout ascending stems 10°–12° tall, or a low much-branched shrub. **Winter-buds** acute, $\frac{1}{8}'$ long, with chestnut-brown scales, scarious on the margins, those of the inner rows

Fig. 512

$\frac{1}{4}'$ long at maturity, oblong, acute, and generally bright red. **Bark** about $\frac{1}{4}'$ thick, gray-brown, deeply fissured, and divided into long thick plates broken on the surface into minute persistent scales. **Wood** heavy, hard, close-grained, pale brown, with thin lighter colored sapwood of 5 or 6 layers of annual growth.

Distribution. Dry rocky hills and open woods usually in the neighborhood of streams, sometimes forming thickets of considerable extent; central Oregon to northeastern California in the region east of the Cascade and Sierra Nevada Mountains, and common to central California; on the foothills of the western slopes of the Sierra Nevada up to altitudes of 4000° south to the Yosemite Valley, and on the coast ranges to Black Mountain, Santa Clara County; of its largest size on the borders of small streams in southern Oregon and northern California; at high altitudes, and in the arid regions of southeastern Oregon a low shrub producing sparingly small sometimes pubescent fruit (var. *oregona* Wight); Klamath Indian Reservation, near Klamath Falls and in Sprague River Valley, Klamath County.

2. Prunus umbellata Ell. Sloe. Black Sloe.

Leaves obovate-lanceolate to oblong, acute at the ends or sometimes rounded or slightly cordate at base, finely and sharply serrate with remote incurved glandular teeth, and usually furnished with 2 large dark glands at the base, when they unfold bright bronze-green, with red margins, midrib, and petiole, glabrous above and pubescent or glabrous below with the exception of a few hairs along the prominent orange-colored midrib and primary veins, and at naturity thin, dark green above, paler below, $2'–2\frac{1}{2}'$ long and $1'–1\frac{1}{2}'$ wide, petioles stout, glabrous or pubescent, about $\frac{1}{3}'$ in length; stipules lanceolate, setaceous, glandular-serrate, $\frac{1}{4}'–\frac{2}{3}'$ long. **Flowers** opening in March and April before the appearance of the leaves, $\frac{2}{3}'$ in diameter, on slender glabrous pedicels $\frac{1}{2}'$ long, in 3 or 4-flowered umbels; calyx-tube broad-obconic, glabrous or puberulous, the lobes sometimes slightly clavate at the acute red apex, scarious on the margins, and hoary-tomentose on the inner surface; petals nearly orbicular, contracted at the base into a short claw. **Fruit** ripening from July to September, on slender stems $\frac{1}{2}'$ to nearly $1'$ long, globose, without a basal depression, about $\frac{1}{2}'$ in diameter, with a tough thick black or on some individuals yellow, and on others bright red skin covered with a glaucous bloom, and thick acid flesh; stone flattened with

thin brittle walls, ½′ long, ¼′–⅝′ wide and half as thick, acute at the ends, slightly rugose, conspicuously ridged on the ventral suture, and slightly grooved on the dorsal suture.

A tree, sometimes 15°–20° high, with a short often crooked or inclining trunk 6′–10′ in diameter, slender unarmed branches forming a wide compact flat-topped head, and slender branchlets more or less densely coated at first with pale pubescence, soon becoming glabrous, lustrous and bright red, and in their second year dark dull brown and marked by

Fig. 513

occasional orange-colored oblong lenticels; or frequently a low shrub. **Winter-buds** about ⅛′ long, with acute chestnut-brown apiculate scales, those of the inner rows at maturity ¼′ long and red at the apex. **Bark** ¼′ thick, dark brown, separating into small appressed persistent scales. **Wood** heavy, hard, close-grained, dark reddish brown, with thick lighter colored sapwood of about 30 layers of annual growth. The fruit is used in large quantities in making jellies and jams.

Distribution. Stanly County (near Albemarle, *J. S. Holmes*), North Carolina, and South Carolina southward, usually in the neighborhood of the coast, to Orange County, Florida, and westward to eastern Texas and southern Arkansas. The form with red fruit common in the interior of the Florida peninsula (Orange County). Variable in the amount of its pubescence and slightly variable in the shape of the fruit, and passing into var. *injucunda* Sarg. (*Prunus mitis* Beadl.) A small tree with branchlets hoary tomentose when they first appear, becoming pubescent, and puberulous in their second season, leaves more or less tomentose below, villose pedicels, calyx and ovary, and subglobose to short-oblong fruit. Central and southern Georgia (base of Stone Mountain and Little Stone Mountain, De Kalb County, and near Augusta, Richmond County), and eastern Alabama (near Auburn, Lee County). More distinct is

Prunus umbellata var. tarda Wight

Prunus tarda Sarg.

Differing from the type in the more oblong stone of the later-ripening fruit, lighter-colored bark and larger size.

Leaves oblong or oval, or occasionally obovate, acute or acuminate and short-pointed at apex, gradually narrowed and cuneate at base, and finely serrate with straight or incurved teeth tipped with dark minute persistent glands, when they unfold glabrous or rarely scabrous or puberulous above and cinereo-tomentose below, and at maturity thick and firm, dark yellow-green and glabrous on the upper surface, pale and pubescent or puberulous on the lower surface, especially along the prominent light yellow midrib and thin primary

veins, $1\frac{1}{2}'$–$3'$ long and $\frac{3}{4}'$–$1\frac{1}{4}'$ wide; petioles stout, tomentose or ultimately pubescent, $\frac{1}{3}'$–$\frac{1}{2}'$ in length, glandular at apex with 2 large round stalked dark glands, or often eglandular; stipules acicular, often bright red, about $\frac{1}{3}'$ long. **Flowers** appearing early in April with or before the leaves, about $\frac{3}{4}'$ in diameter, on slender glabrous pedicels, in 2 or 3-flowered umbels; calyx-tube narrow-obconic, glabrous toward the base, villose above, the lobes acute, entire, villose on the outer surface, hoary-tomentose on the inner surface; petals oblong-obovate, gradually contracted below into a short claw. **Fruit** ripening late in October or early in November, on stout rigid pedicels, short-oblong to subglobose, $\frac{1}{2}'$–$\frac{1}{2}'$ long, clear bright yellow on some trees, bright red on others, and on others purple, dark blue, or black, with tough thick skin, and thick very acid flesh; stone ovoid more or less compressed, very rugose, obscurely ridged on the ventral suture and slightly grooved on the dorsal suture, acute and apiculate at apex, and rounded at base.

A tree, 20°–25° high, with a tall trunk 18′–20′ in diameter, wide-spreading branches forming an open symmetrical head, and slender branchlets marked by small scattered dark lenticels, light-green and hoary-tomentose when they first appear, becoming glabrous, light

Fig. 514

red-brown and lustrous during their first summer and darker at the end of their second year. **Winter-buds** narrow, acute, the color of the branchlets, $\frac{1}{16}'$–$\frac{1}{8}'$ long. **Bark** $\frac{1}{2}'$–$\frac{5}{8}'$ thick, light brown tinged with red, and divided by shallow interrupted fissures into flat ridges broken on the surface into small loose plate-like scales.

Distribution. Glades and open woods in the neighborhood of Marshall, Harrison County, Texas, to western Louisiana, southern Arkansas, and western Mississippi.

3. Prunus nigra Ait Red Plum. Canada Plum.

Leaves oblong-ovate to obovate, abruptly contracted at apex into a long narrow point, cuneate, truncate or slightly cordate at base, and doubly crenate-serrate with small dark glandular teeth, when they unfold faintly tinged with red and pubescent on the under surface or glabrous with the exception of conspicuous tufts of slender white or rufous hairs in the axils of the primary veins, and at maturity thick and firm, dull dark green on the upper surface, pale on the lower surface, $3'$–$5'$ long and $1\frac{1}{2}'$–$3'$ wide, with a conspicuous pale midrib and slender veins; petioles stout, biglandular at apex with 2 large dark glands, $\frac{1}{2}'$–$1'$ in length; stipules lanceolate or on vigorous shoots often 3–5-lobed, glandular-serrate, $\frac{1}{2}'$ long. **Flowers** appearing in early spring with or before the leaves, $1\frac{1}{4}'$ in diameter, on slender glabrous dark red pedicels, $\frac{1}{2}'$–$\frac{2}{3}'$ long, in 3 or 4-flowered umbels; calyx-tube broad-obconic, dark red on the outer surface, bright red on the inner surface, the lobes narrow, acute, glandular, glabrous or occasionally pubescent on the outer surface, reflexed after the flowers open;

petals broad-ovate, rounded at apex, more or less erose on the margins, contracted at base into a short claw, white, turning pink in fading. **Fruit** ripening from the middle to the end of August, oblong-oval, 1′–1¼′ long, with a tough thick orange-red skin nearly destitute of bloom, and yellow rather austere flesh; stone oval, compressed, 1′ long, ⅔′ wide, thick-walled, acutely ridged on the ventral suture and slightly grooved on the dorsal suture.

A tree, 20°–30° high, with a trunk sometimes 8′–10′ in diameter, divided usually 5°–6° from the ground into a number of stout upright branches forming a narrow rigid head, stout slightly zigzag branchlets marked by numerous pale excrescences, bright green, glabrous or puberulous at first, and dark brown tinged with red in their second season, and stout spiny lateral spur-like secondary branchlets. **Winter-buds** acuminate, ⅛′–¼′ long, with chestnut-brown, triangular scales pale and scarious on the margins. **Bark** about ⅛′ thick, light gray-brown, with a smooth outer layer exfoliating in large thick plates of several papery layers, and in falling exposing the darker slightly fissured scaly inner bark. **Wood** heavy, hard, close-grained, rich bright red-brown, with thin lighter colored sapwood.

Distribution. In the alluvial soil of river valleys and on limestone hills; western New Brunswick (near the mouth of the Aroostook River) to the valley of the Saint Lawrence River and westward to the southern shore of Georgian Bay, the northern shore of Lake Superior (west of Port Arthur, Ontario), the valley of the Winnipeg River, Manitoba, and

Fig. 515

southward to northern New England, central and western New York, northern Ohio (Lorraine County), southern Michigan, northern Indiana (*C. C. Deam*), northeastern Illinois, southeastern and western Wisconsin (valley of the Wisconsin River), eastern Minnesota and North Dakota.

Often cultivated in Canadian gardens and occasionally in those of the northern states as a fruit-tree or for the beauty of its flowers. Varieties are propagated by pomologists.

4. Prunus americana Marsh. Wild Plum.

Leaves oval to oblong-oval or slightly obovate, acuminate at apex, narrowed and cuneate or rounded at base, and sharply often doubly serrate with slender apiculate teeth, when they unfold glabrous or slightly pubescent, and often furnished below with conspicuous axillary tufts of pale hairs, and at maturity thick and firm, more or less rugose, dark green on the upper surface, pale and glabrous on the lower surface, 3′–4′ long and 1½′–1¾′ wide, with a thin midrib glabrous or villose-pubescent on the lower side, and slender primary veins; petioles slender, eglandular or furnished near the apex with one or two glands, glabrous or puberulous, ½′–¾′ in length. **Flowers** appearing in early spring before or with the unfolding of the leaves, 1′ in diameter, bad-smelling, on slender glabrous pedicels

$\frac{1}{3}'$–$\frac{2}{3}'$ long, in 2–5-flowered umbels; calyx-tube narrow-obconic, bright red, glabrous or puberulous, green on the inner surface, the lobes lanceolate to oblong-lanceolate, obtuse or acute, eglandular or obscurely glandular above the middle, usually dentate toward the apex, glabrous or puberulous on the outer surface, soft-pubescent on the inner surface; petals rounded and irregularly laciniate at apex, contracted below into a long narrow claw, bright red at base, $\frac{1}{2}'$ long and $\frac{1}{4}'$ wide. **Fruit** ripening in June at the south and from the middle of August to early October at the north, subglobose or slightly elongated, usually rather less than 1′ in diameter, in ripening turning from green to orange often with a red cheek, becoming bright red when fully ripe, usually destitute of bloom and more or less conspicuously marked by pale spots, with a thick tough acerb skin and bright yellow succulent rather juicy acid flesh; stone oval slightly rugose rounded at apex, more or less narrowed at base, $\frac{3}{4}'$–1′ long and $\frac{2}{5}'$–$\frac{3}{5}'$ wide, often as thick as broad, slightly and acutely ridged on the ventral suture and obscurely grooved on the dorsal suture.

A tree 20°–35° high, with a trunk rarely exceeding 1° in diameter and dividing usually 4° or 5° from the ground into many spreading branches often pendulous at the end and forming a broad graceful head and slender glabrous branchlets at first bright green, light orange-brown during their first winter, becoming darker and often tinged with red and marked by minute circular raised lenticels, and furnished with long slender remote sometimes spinescent lateral branchlets; usually spreading by shoots from the roots into broad thickets, or in the Gulf States growing with a single stem. **Winter-buds** acute, $\frac{1}{8}'$–$\frac{1}{4}'$ long, the chestnut-brown scales more or less erose on the margins, the inner scales when fully grown foliaceous, $\frac{1}{2}'$ long, oblong, acute, remotely serrate, with 2 narrow acuminate lateral lobes. **Bark** about $\frac{1}{2}'$ thick, dark brown tinged with red, the outer layer separating into long thin persistent plates, southward often lighter-colored. **Wood** heavy, hard, close-grained, strong, dark rich brown tinged with red, with thin lighter-colored sapwood. The fruit is sometimes used in the preparation of jellies and preserves, and is eaten raw or cooked.

Distribution. In the middle and northern states in rich soil, growing along the borders of streams and swamps; in the south Atlantic states often in river swamps; west of the

Fig. 516

Mississippi on bottom-lands, dry uplands and low mountain slopes; western Connecticut (Gaylordsville, Litchfield County), Eastern Greenbush, Rensselaer County and central New York to southern Ontario, central Michigan and northern Indiana, and northwestward to North Dakota, Manitoba (near Brandon), the Bitter Root Mountains, Wyoming and western Montana (Dixon, Sanders County), and southward to western Florida, central Mississippi, Alabama, eastern Louisiana, Missouri, southern Arkansas, eastern Kansas and Oklahoma, and in the Rocky Mountain region along the eastern foothills of Colorado to

northern New Mexico (near Las Vegas, San Miguel County); and northeastern Utah (near Logan, Cache County); on the southern Appalachian Mountains ascending to altitudes of 3000°, and in South Carolina and Georgia extending to the immediate neighborhood of the coast; in the Rocky Mountain region usually a low shrub forming large thickets. Passing into the var. *floridana* Sarg., differing in its much thinner finely serrate leaves and purple fruit. A small tree without root suckers; low rich woods near St. Marks, Wakulla County, middle Florida; common.

5. Prunus lanata Mack. & Bush.

Prunus americana lanata Sudw.

Prunus Palmeri Sarg.

Leaves ovate to oblong-obovate, elliptic or rarely slightly obovate, abruptly acuminate and long-pointed at apex, gradually narrowed and cuneate or rarely rounded at base, and coarsely often doubly serrate with apiculate spreading teeth, when they unfold sparingly

Fig. 517

covered above by short caducous hairs and below by long white spreading hairs, and at maturity thin, light yellow-green and glabrous on the upper surface, pale and more or less densely covered below with close soft pubescence at the south often becoming fuscous late in the season, and villose on the midrib and primary veins, $2\frac{1}{2}'$–$4'$ long and $1\frac{1}{2}'$–$2\frac{1}{2}'$ wide; petioles slender, pubescent, eglandular or furnished with a gland near the apex, $\frac{1}{2}'$–$\frac{2}{3}'$ in length, stipules linear, acuminate, occasionally 3-lobed, villose, sparingly glandular. **Flowers** about $\frac{3}{4}'$ in diameter, on slender glabrous pedicels $\frac{1}{2}'$–$\frac{2}{3}'$ in length, in 2–5-flowered umbels; calyx-tube narrow-obconic, puberulous, the lobes long, acuminate, entire or rarely slightly serrate toward the apex, ciliate on the margins, puberulous and more or less tinged with red on the outer surface, pubescent on the inner surface; petals oblong-oval, narrowed and rounded at apex, gradually narrowed below into a long claw, about $\frac{1}{4}'$ wide; stamens about 25; style elongated, exceeding the stamens. **Fruit** on drooping glabrous pedicels, ellipsoid, deep crimson covered with a glaucous bloom, often 1′ long and $\frac{4}{5}'$ in diameter, with thick succulent flesh; stone oblong, compressed, rounded at base, pointed and apicu-

late at apex, ridged on the dorsal edge with a thin narrow ridge, thin and slightly grooved on the ventral edge.

A tree 20°–30° high, with a trunk 12′–18′ in diameter, small erect branches and slender unarmed branchlets light yellow-green and puberulous or pubescent when they first appear, usually becoming glabrous before the end of their first season, light orange-brown during their first season and dark red-brown the following year; sometimes a shrub only a few feet tall; usually growing with a single well-developed trunk; occasionally spreading by suckers from the roots into small thickets. **Winter-buds** acute, $\frac{1}{8}'$–$\frac{1}{6}'$ long, with light chestnut-brown puberulous scales ciliate on the margins. **Bark** pale gray-brown, exfoliating in large thin scales.

Distribution. Hillsides and river-bottom lands; southern Indiana (near Columbus, Bartholomew County, and Gordon Hills, Gibson County), through southern Illinois (Gallatin, Pope, Richland and Johnson Counties) to western Kentucky (Ballard and Hickman Counties); through Missouri and Arkansas to eastern Oklahoma, western Louisiana and eastern Texas to Wilson County (Southerland Springs); through eastern Louisiana (West Feliciana and Tammany Parishes), and near Selma, Dallas County, Alabama.

6. Prunus tenuifolia Sarg.

Leaves oblong to oblong-obovate or elliptic, gradually narrowed and acute or acuminate and often abruptly long-pointed at apex, cuneate or often narrowed and rounded at base, finely doubly serrate with teeth pointing to the apex of the leaf, at maturity thin, dark yellow-green and sparingly covered above with short soft white hairs, paler and soft pubes-

Fig. 518

cent below, especially on the slender midrib, and 7 or 8 pairs of thin primary veins connected by occasional cross veinlets, 3′–4′ long and $1\frac{1}{4}'$–2′ wide; petioles slender, pubescent, becoming puberulous or nearly glabrous, glandular near the apex with 1–3 prominent dark glands, or eglandular. **Flowers** $\frac{4}{5}'$ in diameter, opening from the middle to the end of March, on slender pedicels $\frac{2}{5}'$–$\frac{4}{5}'$ long, furnished near the apex with a few long white hairs, in 2–4-flowered sessile umbels; calyx-tube narrow-obconic, glabrous with the exception of occasional long scattered white hairs near the base, the lobes narrow, entire, or minutely dentate near the rounded apex, ciliate on the margins, pubescent on the outer surface, densely villose on the inner surface, reflexed after anthesis; petals white, ovate-oblong, narrowed and rounded at apex, crenulate above the middle, gradually narrowed below into a

short claw. **Fruit** on stout slightly hairy or glabrous stems, oblong to oblong-obovoid, red, covered with a thick glaucous bloom, $\frac{3}{5}'$–$\frac{3}{4}'$ long and $\frac{1}{2}'$–$\frac{3}{5}'$ in diameter, with a thick skin and thin flesh; stone oblong, compressed, pointed at the ends, slightly sulcate at apex, unsymmetric, ridged on the full and rounded dorsal edge with a broad thin ridge, thin nearly straight and only slightly grooved on the ventral edge, $\frac{2}{3}'$–$\frac{3}{5}'$ long and about $\frac{1}{2}'$ wide.

A tree 30° high, with a tall trunk usually about 12′ but occasionally 18′ in diameter, stout spreading branches and stout or slender glabrous branchlets light orange green when they first appear, becoming light gray or red-brown and lustrous at the end of their first season, and dark dull red-brown the following year. **Bark** of the trunk and large branches thick, pale gray, and broken into long platelike scales.

Distribution. Dry Oak-woods near Jacksonville and Larissa, Cherokee County, Texas.

7. Prunus mexicana S. Wats. Big Tree Plum.

Prunus arkansana Sarg.

Leaves ovate to elliptic or obovate, abruptly long-pointed and acuminate at apex, rounded or rarely cuneate and often glandular at base, and finely doubly serrate with apiculate slender straight or slightly incurved teeth, at maturity thick, dark yellow-green,

Fig. 519

glabrous and lustrous on the upper surface, paler and sparingly covered on the lower surface with long soft white hairs most abundant on the prominent midrib and primary veins and on the numerous conspicuous reticulate veinlets, $1\frac{3}{4}'$–$3\frac{1}{4}'$ long and $1\frac{1}{4}'$–$2'$ wide; petioles stout, pubescent or puberulous, glandular at apex with large dark glands, or eglandular, $\frac{2}{3}'$–$\frac{3}{5}'$ in length. **Flowers** appearing in March before the leaves, 1′ in diameter, on slender glabrous pedicels in 3 or 4-flowered sessile umbels; calyx-tube narrow-obconic, glabrous, the lobes oblong or oblong-ovate, about as long as the tube, rounded and laciniate at apex or entire, ciliate and glandular on the margins with small sessile glands, puberulous on the outer surface, hoary-tomentose on the inner surface, reflexed after anthesis; petals sometimes puberulous on the outer surface toward the base, ovate-orbicular to oblong-ovate, rounded at the narrow apex, crenulate, abruptly or gradually narrowed below into a short claw, about 3 times as long as the calyx-lobes; style longer than the stamens. **Fruit**

ripening from the end of August to early October, subglobose to short-oblong, rounded at the ends, dark purple-red with a slight glaucous bloom, $1\frac{1}{4}'$–$1\frac{1}{3}'$ long and $1'$–$1\frac{1}{4}'$ in diameter, with thick succulent flesh; stone smooth obovoid to nearly circular, turgid, unsymmetric, narrowed and rounded at base, rounded or short-pointed at apex, ridged on the rounded dorsal edge with a broad thin ridge, thin, less rounded and grooved on the ventral edge, $\frac{3}{4}'$–$1'$ long and about $\frac{1}{2}'$ wide.

A tree from 20°–25° high, with a trunk sometimes 8′–10′ in diameter, stout branches forming an open irregular head, and slender glabrous branchlets light orange-brown, very lustrous and marked by dark lenticels during their first winter and dull gray-brown the following year. **Winter-buds** ovoid, acute, glabrous, $\frac{1}{4}'$ long. **Bark** dark, nearly black or light gray, exfoliating in platelike scales on young stems and large branches, becoming rough and deeply furrowed on old trunks.

Distribution. Open woods on rich alluvial bottom-lands, upland prairies and hillsides; southeastern Kansas (near Parsons, Labette County), through Arkansas to western Oklahoma (Navina, Logan County, Minca, Grady County), western Louisiana, northern and eastern Texas to the valley of the San Antonio River, ranging westward in Texas over the Edwards Plateau and to Brown and Palo Pinto Counties; in West Feliciana Parish, eastern Louisiana; in Coahuila and Nuevo Leon.

Passing into the following varieties:

Prunus mexicana var. **reticulata** Sarg. Differing in its thicker leaves more often narrowed at base, with more prominent reticulate veinlets, pubescent pedicels, globose fruit ripening late in September or in October, with thin, bitter, astringent flesh and dark deeply furrowed bark.

Distribution. Uplands and along the margins of river bottoms; neighborhood of Denison and Sherman, Grayson County, northern Texas.

Prunus mexicana var. **polyandra** Sarg.

Differing in the narrowed base of the leaves, the more numerous stamens, in its earlier ripening fruit, with an obovoid compressed stone pointed at apex and gradually narrowed and acute at base.

Distribution. Rich woods near Fulton, Hempstead County, Arkansas.

Prunus mexicana var. **fultonensis** Sarg.

Differing in its thinner leaves pubescent below over the whole surface, and in its smaller dark bluish-purple fruit, ripening in June, with thin flesh and a compressed stone pointed at apex and gradually narrowed and acute at base.

Distribution. Rich woods near Fulton, Hempstead County, Arkansas.

8. Prunus alleghaniensis Porter. Sloe.

Leaves lanceolate to oblong-ovate, often long-pointed, finely and sharply serrate with glandular teeth, and furnished at base with 2 large rather conspicuous glands, when they unfold covered with soft pubescence, and at maturity puberulous on the upper surface, and glabrous with the exception of a few hairs in the axils of the veins, or covered, especially along the broad midrib and conspicuous veins, with rufous pubescence on the lower surface, rather thick and firm in texture, dark green above and paler below, $2'$–$3\frac{1}{2}'$ long and $\frac{2}{3}'$–$1\frac{1}{4}'$ wide; petioles slender, grooved, pubescent or puberulous, $\frac{1}{4}'$–$\frac{1}{3}'$ in length. **Flowers** appearing in May with the unfolding of the leaves, $\frac{1}{2}'$ in diameter, on slender puberulous pedicels $\frac{1}{2}'$–$\frac{2}{3}'$ long, in 2–4-flowered umbels; calyx-tube narrow-obconic, pubescent or puberulous on the outer surface, the lobes ovate-oblong, rounded at apex, scarious on the margins, and coated with pale tomentum on the inner surface; petals rounded at apex, contracted at base into a short claw, turning pink in fading. **Fruit** ripening the middle of August, on stout puberulous pedicels, subglobose or slightly oval to obovoid, $\frac{1}{3}'$–$\frac{2}{3}'$ in diameter, with thick rather tough dark reddish-purple skin covered with a glaucous bloom, and yellow juicy austere flesh; stone thin-walled, turgid, two thirds as thick as broad, $\frac{1}{4}'$–$\frac{1}{2}'$ long, pointed at the ends, ridged on the ventral suture, and slightly grooved on the dorsal suture.

A slender tree, occasionally 18°–20° high, with a trunk sometimes 6′–8′ in diameter, divid-

ing into numerous erect rigid branches, and branchlets at first coated with pale caducous pubescence, becoming dark red and rather lustrous in their first winter, and ultimately nearly black, and unarmed, or sometimes armed with stout spinescent lateral spur-like branchlets. **Winter-buds** acuminate or obtuse, $\frac{1}{16}'$ long, their inner scales accrescent, scarious, oblong, acute, $\frac{2}{3}'$ long, bright red at apex. **Bark** $\frac{1}{4}'$ thick, dark brown, fissured and

Fig. 520

broken on the surface into thin persistent scales. **Wood** heavy, hard, close-grained, brown tinged with red, with thin pale sapwood of 10–12 layers of annual growth. The fruit is made into preserves, jellies and jams.

Distribution. Low moist soil, often forming shrubby thickets sometimes of considerable extent, and dry ridges; slopes of Tusseys Mountain in the northwestern part of Huntingdon County, and over the main range of the Alleghany Mountains into Clearfield and Elk Counties, Pennsylvania; rocky ridges near the Natural Bridge, Rockbridge County, Virginia, and lower slopes of Peak Mountain on South Fork of Buffalo Creek, Ashe County, North Carolina (*W. W. Ashe*), and in southern Connecticut; of its largest size on limestone bluffs south of the Little Juniata River, Pennsylvania. A shrubby variety with leaves broader in proportion to their length and less acuminate at apex (var. *Davisii* Wight) occurs in Roscommon and Montmorency Counties, Michigan.

9. Prunus hortulana Bailey. Wild Plum.

Leaves oblong-obovate to oblong-oval or rarely to oblong-lanceolate, acuminate and contracted at apex into a long slender point, cuneate or more or less rounded at the narrow base, and finely serrate with incurved lanceolate glandular teeth, when they unfold pilose with slender white hairs, and at maturity glabrous above, pilose below in the axils of the primary veins and along the midrib with tawny hairs, thin but firm, dark green and lustrous on the upper surface paler on the lower surface, 4′–6′ long and 1′–1½′ wide, with a broad conspicuous orange-colored midrib, primary veins connected near the margins of the leaf, and prominent reticulate veinlets; petioles slender, orange-colored, 1′–1½′ in length and furnished above the middle with numerous scattered dark glands; stipules lanceolate, acuminate, glandular-serrate, early deciduous. **Flowers** appearing in April or early in May when the leaves are about one-third grown, ⅔′–1′ in diameter, on slender puberulous pedicels ½′ long, in 2–4-flowered umbels; calyx-tube narrow-obconic, the lobes about as long as the tube, oblong-ovate, acute or rounded at apex, glandular-serrate, glabrous or puberulous on the outer surface, pubescent or tomentose on the inner surface chiefly toward the base, reflexed after the unfolding of the narrow oval or oblong-orbicular petals rounded and occasionally emarginate at apex, contracted below into a long narrow claw, entire, erose, or occasionally serrate, and white often marked with orange toward the base. **Fruit** ripening in September and October, on stout stems, globose or rarely ellipsoid, ¾′–1′ in diameter,

with thick deep red or sometimes yellow lustrous skin, and hard austere thin flesh; stone turgid, $\frac{2}{3}'$–$\frac{3}{4}'$ long, compressed at the ends, abruptly short-pointed or rounded at apex, rounded or truncate at base, conspicuously ridge-margined on the ventral suture and broadly and deeply grooved on the dorsal suture, thick-walled, usually conspicuously or rarely obscurely rugose and pitted.

A tree 20°–30° high, without suckers from the roots, with a slender often inclining trunk, frequently 5′–6′ or occasionally 10′–12′ in diameter, dividing usually several feet above the ground into thick spreading branches forming a broad round-topped head, and stout rigid branchlets marked by minute pale lenticels, glabrous or slightly puberulous during their first summer, rather dark red-brown, and usually unarmed or on vigorous trees armed with stout spinescent lateral chestnut-colored branchlets; or often a shrub, with many stems forming thicket-like clumps. **Winter-buds** minute, obtuse, with chestnut-brown scales slightly ciliate on the margins, those of the inner ranks becoming oblong-lanceolate, acute, glandular-serrate, sometimes $\frac{1}{2}'$ in length. **Bark** thin, dark brown, separating into large thin persistent plates, and displaying the light brown inner layers.

Distribution. Low banks of streams in rich moist soil; southwestern Illinois to Scott County, Iowa, and to eastern Kansas and northeastern Oklahoma, and to central Kentucky and northwestern Tennessee; most abundant and of its largest size in Missouri. The handsomest of American Plum-trees, and hardy as far north as eastern Massachusetts. Several selected forms are grown and valued by pomologists. Passing into var. *Mineri* Bailey, with darker green duller leaves, and sometimes more scaly bark. Southwestern Illinois to central Missouri; and into var. *pubens* Sarg. differing from the type in its pubescent leaves, petioles and young branchlets. In the neighborhood of Webb City, Jasper County, and to northeastern Missouri and southeastern Kansas.

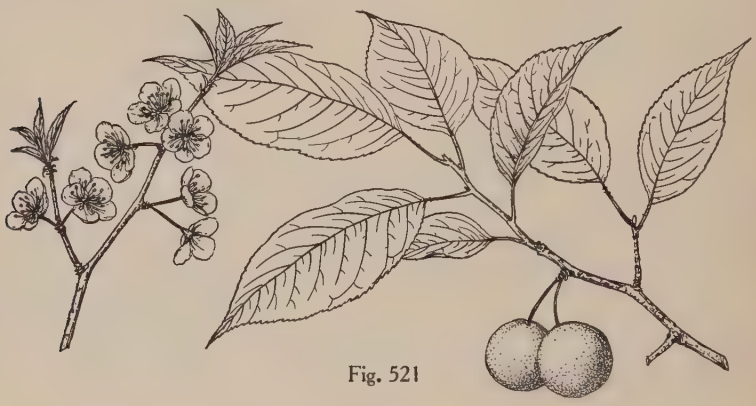

Fig. 521

Often cultivated by pomologists in many selected forms.

10. Prunus Munsoniana Wight & Hedrick

Leaves elliptic to lanceolate, acute or acuminate at apex, gradually narrowed and cuneate or rounded at base and finely glandular-serrate, when they unfold densely villose-pubescent above and glabrous below, and at maturity thin, light green and lustrous on the upper surface, pale on the lower surface, $2\frac{1}{2}'$–$4'$ long and $\frac{3}{4}'$–$1\frac{1}{4}'$ wide, with a slender midrib often red and usually pubescent or sparingly villose on the lower side, and slender primary veins often furnished with small axillary clusters of white hairs; petioles slender, usually biglandular toward the apex, the groove on the upper side covered with white pubescence, often bright red, $\frac{3}{4}'$ in length; stipules linear, glandular-serrate. **Flowers** appearing in Texas before the leaves at the end of March and as late as May after the appearance of the leaves at

Fig. 522

the northern limits of its range, $\frac{1}{2}'$–$\frac{3}{5}'$ in diameter, on slender glabrous pedicels $\frac{2}{5}'$–1′ long, in 2–4-flowered umbellike clusters; calyx-tube broad-obconic, glabrous, obscurely nerved, the lobes ovate, acute or acuminate, minutely glandular-serrate, glabrous or rarely slightly pubescent on the outer surface, pubescent on the inner surface below the middle; petals about $\frac{1}{4}'$ long, obovate to oblong-obovate, entire or sparingly erose, white, about $\frac{1}{4}'$ long, abruptly contracted into a short claw. **Fruit** ripening in July and August, subglobose to short-oblong, $\frac{3}{4}'$ long, bright red with a slight bloom, marked by pale dots and occasionally by yellow blotches, rarely yellow, with a thin skin and light or dark yellow juicy aromatic fibrous flesh often of good quality; stone oval, compressed, pointed at apex, truncate or obliquely truncate at base, thick-margined and grooved on the ventral suture, grooved on the dorsal suture, irregularly roughened on the surface, about $\frac{1}{2}'$ long.

A tree spreading into dense thickets, the oldest central stem sometimes 20° high and 5′ or 6′ in diameter, diminishing in height and size to the margin of the thicket, with erect, rarely slightly spinescent branches, and slender glabrous red-brown lustrous branchlets marked by numerous pale lenticels. **Winter-buds** obtuse, chestnut brown, glabrous, rarely more than $\frac{1}{8}'$ long. **Bark** thin, usually smooth and reddish or chestnut-brown on young stems, becoming gray or grayish brown and separating into thin platelike scales on older trunks.

Distribution. Usually in rich soil; southern Illinois (Alexander, Gallatin, Pope, Johnson and Richland Counties); southwestern Kentucky; central Tennessee; northern Mississippi; central Missouri to southeastern Kansas, and through Arkansas to eastern Oklahoma, western Louisiana (Natchitoches and Lincoln Parishes), and northern Texas west to Clay and Lampasas Counties); now occasionally naturalized from cultivated trees in eastern Texas, and eastward to Georgia, eastern Kentucky, southern Ohio, and in northern Missouri. Hardy in eastern Massachusetts and western New York.

Cultivated in orchards, a tree sometimes 20°–30° tall with a trunk 6′–8′ in diameter, and rather small wide-spreading branches forming a handsome round-topped head. Selected forms of the wild plants are valued by pomologists who have produced several hybrids by crossing *Prunus Munsoniana* with other American and with Old World species. The "Wild Goose Plum," one of the best known forms of *Prunus Munsoniana*, has flowered and produced fruit for many years in the Arnold Arboretum.

11. Prunus angustifolia Marsh. Chickasaw Plum.

Leaves lanceolate to oblong-lanceolate, pointed at the ends, apiculate at apex, and sharply serrate with minute glandular teeth, glabrous or at first sometimes furnished with axillary tufts of long pale hairs, bright green and lustrous on the upper, paler and rather

dull on the lower surface, 1′–2′ long and $\frac{1}{3}$′–$\frac{2}{3}$′ wide; petioles slender, glabrous or puberulous, biglandular near the apex with 2 conspicuous red glands, bright red, $\frac{1}{4}$′–$\frac{1}{2}$′ in length; stipules linear or lobed, glandular-serrate, $\frac{1}{2}$′ long. **Flowers** appearing before the leaves from the beginning of March at the south to the middle of April at the north, $\frac{1}{3}$′ in diameter, on slender glabrous pedicels $\frac{1}{4}$′–$\frac{1}{2}$′ long, in 2–4-flowered umbels; calyx-tube campanuiate, glabrous, the lobes oblong, obtuse, entire ciliate on the margins with slender hairs, pale-pubescent on the inner surface, reflexed at maturity; petals obovate, rounded at apex, contracted at base into a short broad claw, white or creamy white. **Fruit** ripening between the end of May and the end of July, globose or subglobose, about $\frac{1}{2}$′ in diameter, bright red or yellow, rather lustrous, nearly destitute of bloom, with a thin skin, and juicy subacid flesh; stone turgid, rugose, compressed at the ends, nearly $\frac{1}{2}$′ long, more or less thick-margined on the ventral suture and grooved on the dorsal suture.

A tree, 15°–25° high, with a trunk rarely exceeding 8′ in diameter, slender spreading branches, and bright red and lustrous branchlets glabrous or covered at first with short caducous hairs, becoming in their second year dull, darker and often brown, marked with

Fig. 523

occasional horizontal orange-colored lenticels, and frequently armed with long thin spinescent lateral branchlets; spreading into thickets. **Winter-buds** acuminate, $\frac{1}{16}$′ long, with chestnut-brown scales. **Bark** about $\frac{1}{8}$′ thick, dark reddish brown and slightly furrowed, the surface broken into long thick appressed scales. **Wood** heavy, although rather soft, not strong, light brownish red with lighter colored sapwood. The fruit is often sold in the markets of the middle and southern states.

Distribution. Widely naturalized especially in the south Atlantic and Gulf states from southern Delaware and Kentucky to central Florida and eastern Texas, occupying the margins of fields and other waste places near human habitations usually in rich soil; probably native in central Texas and Oklahoma. Passing into var. *varians* Wight & Hedrick, differing from the type in its usually larger leaves occasionally up to 2½′ in length and to 1′ in width, in the longer pedicels of the flowers and in the ovoid to ellipsoid often pointed stone of the red or yellow later ripening fruit. A tree usually spreading into thickets, occasionally 12° high with a trunk 4′ or 5′ in diameter, small branches and slender often spinescent chestnut-brown branchlets. Usually in richer soil than the type, southwestern Kansas (Arkansas City, Desha County), through eastern Oklahoma and southern Arkansas to northern and central Texas (Cherokee County); now occasionally naturalized in the eastern Gulf States and possibly indigenous in Dallas County, Alabama, and Orange County, Florida.

A number of selected forms of this variety, including most of those formerly referred to *Prunus angustifolia*, are grown and valued in southern orchards but are not hardy in the north.

12. Prunus pennsylvanica L. Wild Red Cherry. Bird Cherry.

Leaves oblong-lanceolate, sometimes slightly falcate, acuminate or rarely acute, and finely and sharply serrate with incurved teeth often tipped with minute glands, when they unfold bronze-green, pilose below and slightly viscid, soon becoming green and glabrous, and at maturity bright and lustrous on the upper surface, rather paler on the lower surface, 3′–4½′ long and ¾′–1¼′ wide; turning bright clear yellow some time before falling in the autumn; petioles slender, glabrous or slightly pilose, ½′–1′ in length, and often glandular above the middle; stipules acuminate, glandular-serrate, early deciduous. **Flowers** appearing in early May when the leaves are about half grown, or at the extreme north and at high altitudes as late as the 1st of July, ½′ in diameter, on slender pedicels nearly 1′ long, in

Fig. 524

4 or 5-flowered umbels or corymbs; calyx-tube broad-obconic, glabrous, marked in the mouth of the throat by a conspicuous light orange-colored band, the lobes obtuse, red at apex, and reflexed after the flowers open; petals ¼′ long, nearly orbicular, contracted at base into a short claw, creamy white. **Fruit** ripening from the 1st of July to the 1st of September, globose, ¼′ in diameter, with a thick light red skin, and thin sour flesh; stone oblong, thin-walled, slightly compressed, pointed at apex, rounded at base, about $\frac{3}{10}$′ long, and ridged on the ventral suture.

A tree, with bitter aromatic bark and leaves, 30°–40° high, with a trunk often 18′–20′ in diameter, regular slender horizontal branches forming a narrow usually more or less rounded head, and slender branchlets light red and sometimes slightly puberulous when they first appear, soon glabrous, bright red, lustrous and covered with pale raised lenticels in their first winter, and developing in their second year short thick spur-like lateral branchlets and then covered with dull red bark marked by bright orange-colored lenticels, the outer coat easily separable from the brilliant green inner bark; at the extreme north often a low shrub. **Winter-buds** ovoid to ellipsoid, acute, about $\frac{1}{12}$′ long, with bright red-brown acute scales, ciliate on the margins. **Bark** of young stems and of the branches smooth and thin, bright reddish brown, becoming on old trunks ⅓′–½′ thick, and separating horizontally into broad persistent papery dark red-brown plates marked by irregular horizontal bands of orange-colored lenticels and broken into minute persistent scales. **Wood** light, soft, close-grained, light brown, with thin yellow sapwood. The fruit is often used domestically and in the preparation of cough mixtures.

Distribution. Newfoundland to the shores of Hudson's Bay, and westward in British America to the eastern slopes of the coast range of British Columbia in the valley of the Frazer River, and southward through New England, New York, northern Pennsylvania, central Michigan, northern Indiana, northern Illinois, central Iowa, and on the Appala-

chian Mountains, North Carolina and Tennessee; common in all the forest regions of the extreme northern states, growing in moist rather rich soil; often occupying to the exclusion of other trees large areas cleared by fire of their original forest-covering; common and attaining its largest size on the western slopes of the Big Smoky Mountains in Tennessee. Passing into var. *saximontana* Rehd. differing from the type in its shorter and broader, more coarsely serrate leaves, usually fewer flowered sessile umbels, larger fruit, and smaller size. The Rocky Mountain form; common from Manitoba, the Flathead Lake region, Montana, and northern Wyoming, southward through Colorado.

13. Prunus emarginata Walp. Wild Cherry.

Leaves oblong-obovate to oblanceolate, rounded and usually obtuse or sometimes acute at apex, cuneate and furnished at base with 1 or 2 and sometimes 3 or 4 large dark glands, and serrate with minute subulate glandular teeth, when they unfold puberulous or pubescent on the lower surface and slightly viscid, and at maturity glabrous or pubescent below (var. *mollis* S. Wats.), 1′–3′ long, $\frac{1}{3}$′–1$\frac{1}{2}$′ wide, dark green above and paler below; petioles usually pubescent, $\frac{1}{8}$′–$\frac{1}{4}$′ in length; stipules lanceolate, acuminate, glandular-serrate, deciduous. **Flowers** appearing when the leaves are about half grown, at the end of April at the level of the ocean or as late as the end of June at high altitudes, $\frac{1}{3}$′–$\frac{1}{2}$′ in diameter, on slender pedicels from the axils of foliaceous glabrous glandular-serrate bracts, in

Fig. 525

6–12-flowered glabrous or pubescent corymbs 1′–1$\frac{1}{2}$′ long; calyx-tube obconic, glabrous or puberulous, bright orange-colored in the throat, the lobes short, rounded, emarginate or slightly cleft at apex, sometimes slightly glandular on the margins, reflexed after the flowers open; petals obovate, rounded or emarginate at apex, contracted below into a short claw, white faintly tinged with green. **Fruit** ripening from June to August, on slender pedicels, in long-stalked corymbs often 2′ long, globose, $\frac{1}{4}$′–$\frac{1}{2}$′ in diameter, more or less translucent, with a thick skin bright red at first when fully grown, becoming darker and almost black, and thin bitter astringent flesh; stone ovoid, turgid about $\frac{1}{3}$′ long, pointed and compressed at the ends, with thick brittle slightly pitted walls, ridged and prominently grooved on the ventral suture and rounded and slightly grooved on the dorsal suture.

A tree, occasionally 30°–40° high, with exceedingly bitter bark and leaves, a trunk 12′–14′ in diameter, slender rather upright branches forming a symmetric oblong head, and slender flexible branchlets coated at first with pale pubescence, dark red-brown during their first winter, bright red, conspicuously marked by large pale lenticels in their second season, and furnished with short lateral branchlets; frequently a shrub especially at high altitudes, with spreading stems 3°–10° tall forming dense thickets. **Winter-buds** acute, $\frac{1}{8}$′ long, with chestnut-brown scales often slightly scarious on the margins, those of the inner

ranks becoming acuminate, glandular-serrate above the middle, with bright red tips, scarious, and $\frac{1}{2}'$ long. **Bark** about $\frac{1}{4}'$ thick, with a generally smooth dark brown surface marked by horizontal light gray interrupted bands and by rows of oblong orange-colored lenticels. **Wood** close-grained, soft and brittle, brown streaked with green, with paler sapwood of 8–10 layers of annual growth.

Distribution Usually near the banks of streams in low rich soil, or less commonly on dry hillsides; valley of the upper Jocko River, Montana, on the mountain ranges of Idaho and Washington and of southern British Columbia to Vancouver Island, and southward on the coast and interior ranges to the neighborhood of the bay of San Francisco, on the western slopes of the Sierra Nevada up to altitudes of 5000°–6000° above the sea to the head of Kern River, on the Santa Lucia, San Rafael, and San Bernardino Mountains, California, on the Washoe Mountains, Nevada, and the mountains of northern Arizona; of its largest size on Vancouver Island, in western Oregon and Washington, and on the Santa Lucia Mountains; on the coast ranges of middle California and on the Sierra Nevada commonly a shrub 5°–8° high.

14. Prunus virginiana L. Choke Cherry.

Leaves oval, oblong or obovate, abruptly short-pointed at apex, cuneate, rounded or rarely slightly cordate at base, and sharply often doubly serrate with spreading subulate teeth, glabrous when they unfold or furnished below with axillary tufts of pale hairs, and at maturity dark green and lustrous on the upper surface, light green or pale on the lower sur-

Fig. 526

face, 2′–4′ long and 1′–2′ wide; turning bright clear yellow in the autumn before falling; petioles slender, biglandular near apex, or on vigorous shoots sometimes many-glandular, $\frac{1}{2}'$–1′ in length; stipules lanceolate, about $\frac{1}{2}'$ long, early deciduous. **Flowers** opening from April to the end of June, $\frac{1}{3}'$–$\frac{1}{2}'$ in diameter, on slender glabrous pedicels from the axils of scarious caducous bracts, in erect or nodding racemes 3′–6′ in length; calyx-tube cup-shaped, globose, the lobes short, obtuse, laciniate and more or less glandular on the margins; petals orbicular, contracted into a short claw, white; filaments and pistil glabrous, the short thick style abruptly enlarged into a broad orbicular stigma. **Fruit** globose or occasionally slightly elongated, $\frac{1}{4}'$–$\frac{1}{3}'$ in diameter, lustrous, bright red at first when fully grown, becoming at maturity scarlet, dark vinous red or nearly black, or rarely bright canary color (var. *leucocarpa* S. Wats.), with a thick lustrous skin, and dark juicy flesh, austere and astringent, becoming at maturity less astringent and sometimes edible; stone oblong-ovoid broadly ridged on one suture and acute on the other.

A tree occasionally 20°–25° high, with a straight trunk sometimes 6′–8′ in diameter, small erect or horizontal branches, and slender glabrous red-brown or orange-brown lustrous

branchlets marked by pale lenticels, becoming dark red-brown in their second year; more often a large or small shrub, at the north frequently not more than 2°–3° tall. **Winter-buds** acute or obtuse, with pale chestnut brown scales rounded at apex and more or less scarious on the margins, those of the inner rank becoming lanceolate or ligulate, sharply and often glandular-serrate, and ½′–1′ in length. **Bark** strongly and disagreeably scented, about ⅛′ thick, slightly and irregularly fissured, separating on the surface into small persistent dark red-brown scales, and often marked by pale irregular excrescences. **Wood** heavy, hard, close-grained, not strong, light brown, with thick lighter-colored sapwood of 15–20 layers of annual growth.

Distribution. Margins of the forest, generally in rich rather moist soil, and along highways and fence-rows; Newfoundland, through Labrador to the shores of Hudson's Bay, and southward to the valley of the Potomac River and northern Kentucky; in Buncombe and Iredell Counties, North Carolina, and Talladega County, Alabama, and westward to Saskatchewan, eastern North and South Dakota and Nebraska, northern Missouri and Kansas; more often a tree southward and in cultivation. Passing into the var. *melanocarpa* Sarg. with rather thicker rarely lanceolate leaves, and usually darker often less astringent rarely yellow (*f. xanthocarpa* Sarg.) fruit.

Distribution. Low valleys and the slopes of mountain ranges; Manitoba, western North and South Dakota, Nebraska, Kansas and Oklahoma, westward to northern British Columbia, and southward in the Rocky Mountain region through Wyoming, Montana and Idaho, Colorado, Utah and Nevada to southern New Mexico and Arizona, and through Washington, Oregon and California to San Diego County; in the rich soil of valleys a tree sometimes 30° tall; on dry mountain slopes a shrub 2° or 3° high. More distinct is

Prunus virginiana var. demissa Sarg.

Cerasus demissa Nutt.

Differing in its often cordate leaves covered below with pale pubescence.

Distribution. Prairies and valleys of western Washington and Oregon, southward to

Fig. 527

Siskiyou, Napa, Santa Cruz and Kern Counties, California, in northern Nebraska, central Iowa, Stark County, Illinois (*V. H. Chase*), Laporte County, Indiana (*C. C. Deam*), western Texas (Gamble's Ranch, Armstrong County, with pubescent leaves cuneate at base), and in New Mexico.

Passing into var. *demissa* f. *pachyrrachis* Sarg. (*Padus valida* Woot. & Stanl.) differing in the cuneate or rounded base of the leaves, villose pubescent on the midrib and veins below, in the stouter pubescent rachis and pedicels, and in the pubescent branchlets usually becoming glabrous at the end of their second season.

Distribution. Common on the mountains of southwestern New Mexico (Sierra County) and rarely in southern California.

15. Prunus serotina Ehrh. Wild Black Cherry. Rum Cherry.

Prunus eximia Small.

Leaves oval, oblong or oblong-lanceolate, gradually or sometimes abruptly acuminate at apex, cuneate at base, finely serrate with appressed incurved callous teeth, and furnished at the very base with 1 or more dark red conspicuous glands, when they unfold slightly

Fig. 528

hairy below on the midrib, and often bronze-green, and at maturity glabrous, thick and firm, subcoriaceous, dark green and very lustrous above, paler below, 2′–6′ long and 1′–1½′ wide, with a thin conspicuous midrib rarely furnished toward the base with a fringe of rusty tomentum and slender veins; in the autumn turning clear bright yellow before falling; petioles slender, ½′–¾′ in length; stipules lanceolate, acuminate, glandular-serrate, ½′–¾′ in length, early deciduous. **Flowers** appearing when the leaves are about half grown, from the end of March in Texas to the first week of June in the valley of the St. Lawrence River, ¼′ in diameter, on slender glabrous or puberulous pedicels from the axils of minute scarious caducous bracts, in erect or ultimately spreading narrow many-flowered racemes 4′–6′ long; calyx-tube saucer-shaped, glabrous or puberulous, the lobes short, ovate-oblong, acute, slightly laciniate on the margins, reflexed after the flowers open, persistent on the ripe fruit; petals broad-obovate, pure white. **Fruit** ripening from June to October, in drooping racemes, depressed-globose, slightly lobed, ⅓′–½′ in diameter, dark red when fully grown, almost black when ripe, with a thin skin, and dark purple juicy flesh of a pleasant vinous flavor; stone oblong-obovoid thin-walled, about ⅓′ long, acute at apex, gradually narrowed at base, broadly ridged on the ventral suture and acute on the dorsal suture.

A tree, with bitter aromatic bark and leaves, sometimes 100° high, with a trunk 4°–5° in diameter, small horizontal branches forming a narrow oblong head, and slender rather rigid glabrous branchlets at first pale green or bronze color, soon becoming bright red or dark brown tinged with red, red-brown or gray-brown and marked by minute pale lenticels during their first winter, and bright red the following year; usually much smaller and occasion-

ally toward the northern limits of its range shrub-like in habit. **Winter-buds** obtuse, or on sterile shoots acute, with bright chestnut-brown broad-ovate scales keeled on the back and apiculate at apex, those of the inner ranks becoming scarious at maturity, acuminate, and $\frac{1}{2}'$–$\frac{2}{3}'$ long. **Bark** $\frac{1}{2}'$–$\frac{3}{4}'$ thick, broken by reticulated fissures into small irregular plates scaly on the surface, and dark red-brown, or near the Gulf-coast light gray or nearly white. **Wood** light, strong, rather hard, close straight-grained, with a satiny surface, light brown or red, with thin yellow sapwood of 10–12 layers of annual growth; largely used in cabinet-making and the interior finish of houses. The bark, especially that of the branches and roots, yields hydrocyanic acid used in medicine as a tonic and sedative. The ripe fruit is used to flavor alcoholic liquors.

Distribution. Nova Scotia westward through the Canadian provinces to Lake Superior, and southward through the eastern states to central (Lake County) Florida, and westward to eastern South Dakota, southeastern Nebraska, eastern Kansas, central Oklahoma and the valley of the east fork of the Frio River, Texas; usually in rich moist soil; once very abundant in all the Appalachian region, reaching its greatest size on the slopes of the high Alleghany Mountains from West Virginia to Georgia, and in Alabama; sometimes on low sandy soil, and often in New England on rocky cliffs within reach of the spray of the ocean; not common in the coast region of the southern states.

A form from the summits of White Top Mountain, Virginia, with larger and rather thicker leaves pale below and rather larger fruit, has been described as var. *montana* Britt.

16. Prunus alabamensis Mohr. Wild Cherry.

Leaves oval, broad-ovate, or occasionally obovate, acute, short-pointed or rounded at apex, cuneate, rounded or rarely slightly obcordate at base, and finely serrate with incurved teeth tipped with minute or sometimes near the base of the blade with larger dark glands, when they unfold coated below and on the upper side of the midrib with fine pubescence, and at maturity thick and firm in texture, 4′–5′ long, about 2′ wide, dark dull green and glabrous on the upper surface, dull and covered on the lower surface with short simple or

Fig. 529

forked accrescent hairs most abundant and sometimes rufescent on the slender midrib and primary veins; petioles stout, tomentose, becoming pubescent, eglandular or occasionally furnished near the apex with 1 or 2 large dark glands, $\frac{1}{4}'$–$\frac{1}{2}'$ in length; stipules lanceolate, acuminate, glandular-serrate, bright red, $\frac{1}{2}'$ long, caducous. **Flowers** appearing during the first week of May, when the leaves are about half grown, $\frac{1}{4}'$ in diameter, on pubescent pedicels from the axils of ovate or obovate acuminate bright pink caducous bracts, in spreading

or erect slender pubescent racemes 3′–4′ long; calyx-tube broad, cup-shaped, puberulous, with short almost triangular lobes persistent on the fruit; petals white, nearly orbicular. **Fruit** ripening late in September, subglobose to short-oblong, $\frac{1}{3}$′ in diameter, dark red or finally nearly black, with thin acid flesh; stone ovoid somewhat compressed, pointed at the ends, $\frac{1}{4}$′ long, ridged on the ventral suture with a broad low ridge, and slightly grooved on the dorsal suture.

A tree, 25°–30° high, with a short trunk rarely 10′ in diameter, spreading somewhat drooping branches, and slender branchlets coated at first with pale tomentum, dark red-brown during their first season, becoming nearly glabrous before winter, and much darker in their second year. **Bark** of the trunk dark, rough, separating freely into small thin scales.

Distribution. Summits of the low mountains of central Alabama; rare and local.

17. Prunus australis Beadl. Wild Cherry.

Leaves obovate, oval or elliptic, gradually narrowed and obtusely short-pointed or sometimes acute at apex, rounded or occasionally cuneate at the narrowed base, and finely serrate with slender teeth tipped with minute dark red glands, when they unfold membranaceous,

Fig. 530

pale yellow-green and glabrous above, with the exception of occasional pale hairs along the midrib, and coated below with pale or ferrugineous pubescence, and at maturity thin but firm, dark dull green above, covered below with rufous hairs most abundant on the thin broad midrib, and on the slender primary veins extending nearly to the margins of the leaf, conspicuously reticulate-venulose, $2\frac{1}{2}$′–4′ long and $1\frac{1}{2}$′–$2\frac{1}{2}$′ wide; petioles rusty-tomentose, biglandular at apex with large dark glands, about $\frac{1}{4}$′ in length; stipules linear to linear-lanceolate, glandular, bright rose color, $\frac{1}{4}$′–$\frac{1}{2}$′ long. **Flowers** probably opening toward the end of April, on short pedicels from the axils of minute rose-colored caducous bracts, in slender spreading hoary-pubescent racemes 3′–4′ long; the expanded flowers not known. **Fruit** ripening and falling late in July, on pedicels $\frac{1}{4}$′ long, globose, surrounded at base by the calyx-lobes and remnants of the stamens, dark purple when fully ripe, and about $\frac{1}{4}$′ in diameter, with thin flesh; stone ovoid, compressed, rounded at base, pointed at apex, about $\frac{1}{6}$′ long and broad, ridged on the ventral suture, with a low broad ridge, slightly grooved on the dorsal suture.

A tree, sometimes 60° tall, with a trunk 12′–16′ in diameter, spreading or ascending branches forming an oblong head, and slender branchlets coated at first with pale pubescence, becoming puberulous, dull red-brown, and roughened by numerous small pale elevated lenticels at the end of their first season, and glabrous or puberulous in their second

year. **Winter-buds** ovoid, obtuse, about $\frac{1}{12}'$ long, with acute dark red-brown glabrous scales. **Bark** of young stems and of the branches thin, silvery gray, and roughened by long horizontal lenticels, becoming on older trunks $\frac{1}{3}'$ thick, ashy gray or brownish black, deeply fissured and broken into thick persistent platelike scales.

Distribution. Clay soil at Evergreen, Conecuh County, Alabama; common.

18. Prunus virens Shrive. Wild Cherry.

Padus virens Woot. & Stanl.

Prunus serotina, ed. 1, in so far as relates to western Texas, New Mexico and Arizona.

Leaves elliptic, ovate or rarely slightly obovate, acute, rounded or occasionally acuminate or abruptly narrowed into a short obtuse point at apex, rounded or broad-cuneate at base, finely crenately serrate, glabrous, light green and lustrous on the upper surface,

Fig. 531

lighter green and glabrous on the lower surface, $1\frac{1}{2}'$–$2'$ long and $\frac{3}{4}'$–$1'$ wide, with a slender midrib, thin veins and reticulate veinlets; petioles slender, glabrous or rarely slightly villose, without glands, $\frac{1}{4}'$–$\frac{1}{2}'$ in length. **Flowers** appearing when the leaves are nearly fully grown from the first to the middle of May, $\frac{1}{4}'$ in diameter, on slender glabrous pedicels, in erect or spreading many-flowered glabrous or puberulous racemes 3′–6′ long; calyx-tube saucer-shaped, glabrous, $\frac{3}{16}'$ wide, persistent under the fruit, the lobes short-pointed, acute, persistent; petals broad-obovate, pure white. **Fruit** ripening in August and September, in erect or spreading racemes, subglobose to short-oblong, purplish black and lustrous at maturity, $\frac{1}{4}'$–$\frac{1}{2}'$ in diameter, with thin juicy acrid flesh; stone compressed, slightly obovoid $\frac{1}{4}'$ in diameter, with a low broad ridge on the ventral suture, and rounded on the dorsal suture.

A tree in sheltered cañons sometimes 25°–30° high, with a trunk 18′ or 20′ in diameter, small, usually drooping or occasionally wide-spreading branches, and slender glabrous red-brown pendulous branchlets marked by small pale lenticels, becoming gray-brown in their second year; on open mountain slopes a shrub with numerous erect stems and usually smaller leaves. **Winter-buds** acute or acuminate, $\frac{1}{16}'$–$\frac{1}{8}'$ long, with slightly villose red-brown scales. **Bark** near the base of old trunks $\frac{1}{4}'$ thick, nearly black, deeply fissured and broken on the surface into thin persistent scales, higher on the trunk and on small stems thin, smooth, reddish or gray-brown, lustrous and marked by many narrow oblong pale horizontal lenticels.

Distribution. Guadalupe Mountains, western Texas, over the mountain ranges of southern New Mexico and Arizona, extending northward in Arizona to the cañons of the

Colorado plateau south of the Colorado River; widely and generally distributed at altitudes between 5000° and 8000°, but nowhere abundant. Passing into var. *rufula* Sarg., differing in the rusty brown pubescence on the lower side of the midrib of the leaves, in the pubescent petiole and lower part of the rachis, in the puberulous ovary, and in the rusty brown pubescence of the young branchlets.

Distribution. With the species on many of the mountain ranges of southern New Mexico and Arizona at altitudes between 5400° and 6000°.

19. Prunus caroliniana Ait. Wild Orange. Mock Orange.

Leaves oblong-lanceolate, acuminate, mucronate, with entire thickened slightly revolute margins, or rarely remotely spinulose-serrate, glabrous, coriaceous, dark green and lustrous on the upper surface, paler on the lower surface, 2′–4½′ long and ¾′–1½′ wide, and obscurely veined, with a narrow pale midrib; persistent until their second year; petioles stout, broad, orange-colored; stipules foliaceous, lanceolate, acuminate. **Flowers** appearing from February to April, on slender pedicels about ½′ long, from the axils of long-acuminate scarious red-tipped bracts, in dense racemes shorter than leaves; calyx-tube narrow-obconic, the lobes small, thin, rounded, undulate on the margins, reflexed after the flowers open, deciduous; petals boat-shaped, minute, cream-colored; stamens exserted, orange-colored, with glabrous filaments and large pale anthers; ovary gradually narrowed into a slender erect style enlarged above into a club-shaped stigma. **Fruit** ripening in the autumn, remaining on the branches until after the flowering period of the following year, oblong, short-pointed, black and lustrous, ½′ long, with a thick skin, and thin dry flesh; stone short-ovoid, pointed, nearly cylindric, about ½′ long, full and rounded at base, with thin fragile walls, obscurely ridged on the ventral suture and deeply grooved on the dorsal suture.

A tree, 30°–40° high, with a straight or inclining trunk sometimes 10′ in diameter, slender horizontal branches forming a narrow oblong or sometimes a broad head, and glabrous branchlets marked by occasional pale lenticels, slightly angled, at first light green, becoming bright red, and in the second season light brown or gray. **Winter-buds** acuminate, ⅛′

Fig. 532

long, covered with narrow pointed dark chestnut-brown scales rounded on the back. **Bark** about ⅛′ thick, gray, smooth or slightly roughened by longitudinal fissures, and marked by large irregular dark blotches. **Wood** heavy, hard, strong, close-grained, light red-brown or sometimes rich dark brown, with thick lighter colored sapwood. The partially withered leaves and young branches are often fatal to animals browsing upon them, owing to the considerable quantities of hydrocyanic acid which they contain.

Distribution. Deep rich moist bottom-lands; valley of the Cape Fear River, North Carolina, to the shores of Bay Biscayne and the valley of the Kissimee River, Florida, and through southern Alabama, Mississippi, and Louisiana to the valley of the Guadalupe River, Texas; in Bermuda; in the Atlantic and eastern Gulf states usually only in the immediate neighborhood of the sea, rarely ranging inland more than fifteen or twenty miles; common along the borders of hummocks in the center of the Florida peninsula and a characteristic tree on those in the region of Lake Apopka, Orange County; in Alabama ranging inland to Dallas County (Pleasant Hill, *T. G. Harbison*); most abundant and of its largest size in the valleys of eastern Texas, and here often forming great impenetrable thickets.

Often cultivated in the southern states as an ornamental plant and to form hedges; and when cultivated occasionally 50°–60° high, with a trunk 3° in diameter.

20. Prunus myrtifolia Urb.

Prunus sphærocarpa Sw.

Leaves elliptic to oblong-ovate, gradually or abruptly contracted into a broad obtuse point, or less commonly rounded or rarely emarginate at apex, cuneate at base, entire, with

Fig. 533

slightly thickened undulate margins, glabrous, eglandular, subcoriaceous, yellow-green and lustrous on the upper surface, paler on the lower surface, obscurely veined, 2′–4½′ long and 1′–1½′ wide; persistent; petioles slender, orange-brown, ½′ to 1′ in length; stipules foliaceous, lanceolate, acuminate, entire, ¼′ long, early deciduous. **Flowers** opening in Florida in November, ⅛′ in diameter, on thin orange-colored pedicels ¼′–⅔′ long, in slender many-flowered erect racemes shorter than the leaves; calyx-tube obconic, bright orange-colored on the outer surface, marked by an orange band in the throat, the lobes thin, minute, acute, laciniate on the margins, deciduous, much shorter than the obovate rounded or acuminate white petals marked with yellow on the inner surface toward the base, contracted below into a short claw, reflexed at maturity; stamens exserted, with slender orange-colored subulate filaments and small yellow anthers; ovary sessile, contracted into a short stout style, terminating in a large club-shaped stigma. **Fruit** produced in Florida very sparingly, ripening either in the spring or early summer, subglobose to short-oblong, apiculate, orange-brown, ⅓′–½′ long, with thin dry flesh; stone thin-walled, cylindric, slightly narrowed at apex, and obscurely ridged on the ventral suture.

A glabrous tree, in Florida rarely 30°–40° high, with a trunk 5′–6′ in diameter, thin upright branches and slender orange-brown branchlets, becoming ashy gray or light brown tinged with red and marked by small circular pale lenticels. **Bark** of the trunk thin, smooth

or slightly reticulate-fissured, light brown tinged with red. **Wood** heavy, hard, close-grained, light clear red, with thick pale sapwood.

Distribution. Florida, rich hummock land, occasionally in the neighborhood of small streams and ponds near the shore of Bay Biscayne and on Long Key in the Everglades, Dade County; through the West Indies to Brazil.

21. Prunus ilicifolia Walp. Islay

Leaves ovate to ovate-lanceolate, acute, rounded or emarginate at apex, narrowed and rounded or truncate at base, with thickened coarsely spinosely toothed margins, the stout teeth near the base of the leaf often tipped with large dark glands, thick and coriaceous, dark green and lustrous above, paler and yellow-green below, 1′–2½′ long, and 1′–1½′ wide, with a slender yellow midrib and obscure veins; deciduous during their second summer; petioles broad, ⅛′–½′ in length; stipules acuminate, obscurely denticulate, ¼′ long. **Flowers** opening from March to May, ⅓′ in diameter, on short slender pedicels from the axils of acuminate scarious bracts ¼′ in length and mostly deciduous before the opening of the flower-buds, in slender erect racemes 1½′–3′ long; calyx-tube cup-shaped, orange-brown, the lobes minute, acuminate, reflexed at maturity, deciduous, about one third as long as the obovate white petals rounded above and narrowed below into a short claw; stamens slightly exserted, with slender incurved filaments and minute yellow anthers; ovary sessile, abruptly contracted into a slender style usually bent near the summit at a right angle or rarely erect, and surmounted by a large orbicular stigma. **Fruit** ripening in November and December, subglobose, often compressed, ½′–⅔′ in diameter, dark red when fully grown, purple or sometimes nearly black at maturity, with thin slightly acid astringent flesh; stone ovoid slightly compressed, ½′–⅝′ long, short-pointed at apex, with thin brittle walls, light yellow-brown, conspicuously marked by reticulate orange-colored vein-like lines and with 3 orange bands radiating from the base to the apex along one suture, and with a single narrow band along the other suture.

A glabrous tree, 20°–30° high, with a trunk rarely 2° in diameter or more than 10°–12° long, stout spreading branches forming a dense compact head, and branchlets at first yel-

Fig. 534

low-green or orange color, soon becoming gray or reddish brown and more or less conspicuously marked by minute pale lenticels, and in their second or third years by the large leaf-scars; usually much smaller and often a shrub sometimes only a foot or two high. **Winter-buds** acuminate, with dark red scales contracted into a long slender point, those of the inner ranks accrescent and persistent on the young branchlets until these have reached a length of several inches. **Bark** ⅓′–½′ thick, dark red-brown, and divided by deep fissures into

small square plates. **Wood** heavy, hard, strong, close-grained, light red-brown, with thin lighter colored sapwood of 8–10 layers of annual growth; occasionally used for fuel.

Distribution. Borders of streams and moist sandy soil in the bottoms of cañons, and as a low shrub on dry hillsides and mesas from Solano County and the shores of the Bay of San Francisco southward through the coast ranges of California to the foothills of the San Bernardino Mountains, and the valley of the San Jacinto River; in Lower California southward to the western slopes of the San Pedro Mártir Mountains.

Generally cultivated as an ornamental plant in California and occasionally in western and southern Europe.

22. Prunus Lyonii Sarg.

Prunus integrifolia Sarg.

Leaves ovate to lanceolate, acuminate or abruptly narrowed into a short point at apex, cuneate, truncate or rounded at base, with thickened revolute undulate entire or occasionally, especially on vigorous shoots, remotely and minutely spinulose-dentate margins, gla-

Fig. 535

brous, coriaceous, dark green and lustrous above, paler below, reticulate-venulose, 2′–3′ long and ½′–2½′ wide, with a stout midrib and obscure veins; persistent; petioles stout, yellow, ⅓′–½′ in length. **Flowers** appearing from March to June, about ¼′ in diameter, on slender pedicels from the axils of acuminate caducous bracts, in crowded many-flowered glabrous racemes 3′–4′ long; calyx-tube cup-shaped, orange-brown, the lobes acute, apiculate, reflexed after the flowers open, deciduous, about one third as long as the obovate petals rounded and undulate above and narrowed below into a short claw; stamens slightly exserted, with incurved filaments and small yellow anthers; ovary raised on a short stipe, the style bent near the apex and terminating in a large orbicular stigma. **Fruit** ripening late in the autumn, on stout pedicels, in drooping few-fruited racemes, subglobose to short-oblong, dark purple or nearly black at maturity, 1′–1¼′ in diameter, with thick luscious flesh sometimes ¼′ thick; stone ovoid to obovoid, slightly compressed, thin-walled, about ¾′ long, pointed at apex, pale yellow-brown, conspicuously marked by reticulate orange-colored lines, and by 3 dark bands radiating from base to apex along one suture, and by a single narrow line on the other suture.

A bushy tree, sometimes 25°–30° high, with one or several stout erect or spreading stems 1°–3° in diameter, spreading branches forming a broad compact head, and stout branchlets light yellow-green when they first appear, becoming light and ultimately dark reddish brown, and much roughened by the large elevated leaf-scars. **Winter-buds** acute or ob-

tuse, with dark red scales. **Bark** of the trunk $\frac{1}{3}'$–$\frac{1}{2}'$ thick and dark reddish brown. **Wood** heavy, hard, very close-grained, pale reddish brown, with hardly distinguishable sapwood.

Distribution. Islands of southern California, in all situations from the fertile valleys and cañons at the water's edge up to altitudes of 3000° on the dry interior ridges; in Lower California.

11. CHRYSOBALANUS L.

Trees or shrubs, with stout branchlets covered with pale lenticels, and fibrous roots. Leaves alternate, entire, coriaceous, short-petiolate, persistent; stipules minute, deciduous. Flowers perfect, short-pedicellate, small, creamy white, in axillary or terminal dichotomously branched slender canescent cymes, with conspicuous deciduous bracts; calyx turbinate-campanulate, 5-lobed, the lobes imbricated in the bud, without bracts, deciduous; disk thin, adnate to the calyx-tube; petals 5, alternate with the lobes of the calyx, spatulate, deciduous; stamens (in the arborescent species) indefinite in a single continuous series, inserted with the petals on the margin of the disk; filaments filiform, hairy, free or slightly united at base; anthers ovoid, ovary sessile in the bottom of the calyx-tube, pubescent or glabrous, 1-celled; style rising from the base of the ovary, filiform, terminated by a minute truncate stigma; ovules 2, collateral, ascending; raphe dorsal; the micropyle inferior. Fruit a fleshy 1-seeded drupe with pulpy flesh, a coriaceous or crustaceous stone 5 or 6-angled toward the base and imperfectly 5 or 6-valved, the valves reticulate-veined. Seed erect; seed-coat chartaceous, light brown; embryo filling the cavity of the seed; cotyledons thick and fleshy; radicle inferior, very short.

Chrysobalanus is represented in the south Atlantic states by a shrubby species confined to the coast region from Georgia to Alabama, and by an arborescent species, an inhabitant of the shores of southern Florida, and widely distributed through the maritime regions of tropical America, and found in various forms on the coast of western tropical Africa. The insipid fruit of the arborescent species is eaten by negroes; the seeds contain a considerable quantity of oil; and the astringent bark, leaves and roots have been used in medicine.

The generic name is from χρυσός and βάλανος, in allusion to the supposed golden fruit of one of the species.

1. Chrysobalanus icaco L. Cocoa Plum.

Leaves broad-elliptic or round-obovate, rounded or slightly emarginate at apex, cuneate

Fig. 536

at base, glabrous, coriaceous, obscurely reticulate-veined, dark green and lustrous on the upper surface, light yellow-green on the lower surface, 1′–3½′ long and 1′–2½′ wide, with a

broad conspicuous midrib rounded on the upper side and thin primary veins, standing on the branches at an acute angle and appearing to be pressed against them; petioles stout, $\frac{1}{8}'$–$\frac{1}{4}'$ in length; stipules acuminate, $\frac{1}{8}'$ long. **Flowers** $\frac{1}{3}'$ long, on short thick club-shaped hoary-tomentose pedicels, in cymes 1′–2′ in length; appearing in Florida continuously during the spring and summer months on the growing branches; calyx hoary-tomentose, the lobes nearly triangular, acute, more or less pubescent on the inner surface and about half as long as the narrow white petals; ovary hoary-pubescent; style long and slender, clothed nearly to the apex with pale hairs. **Fruit** nearly globose or oval-ovoid, $1\frac{1}{2}'$–$1\frac{3}{4}'$ in diameter, with a smooth bright pink, yellow, or creamy white skin, white sweet juicy flesh often $\frac{1}{4}'$ thick, and more or less adherent to the stone rounded at base, acute or acuminate at apex, 5 or 6-angled below the middle, about a′ long and twice as long as broad, indehiscent or finally separating into 5 or 6 valves, the walls composed of a thin red-brown dry outer layer and a thick interior layer of hard woody fibre; seed-coat lined with a thick white reticulated fibrous coat.

Usually a broad shrub 10°–12° high, forming dense thickets, with erect branches and dark red-brown branchlets thickly covered for four or five years with lenticels, occasionally on the borders of low hummocks arborescent with reclining or rarely erect stems 20°–30° long and 1° in diameter, or on the margins of ocean beaches often not more than 1° or 2° tall. **Bark** dark red-brown and scaly, separating into long thin scales. **Wood** heavy, hard, strong, close-grained, light brown often tinged with red, with thin lighter colored sapwood of about 10 layers of annual growth.

Distribution. Florida, saline shores, river banks and low hummocks, Cape Canaveral to Bay Biscayne, and on the west coast from the mouth of the Caloosahatchee River to the southern keys; through the West Indies to southern Brazil, and on the tropical west coast of Africa. Passing into

Chrysobalanus icaco var. pellocarpa DC.

Differing from the type in its rather larger leaves spreading and less crowded on the branches, its oblong to oblong-obovoid dark purple or nearly black usually rather smaller fruit, and in its long-acuminate and more prominently angled stone.

A tree, 20°–30° or rarely 50° high, with an erect trunk 12′–16′ in diameter, erect and

Fig. 537

spreading branches forming a wide open head, and slender branchlets marked by scattered pale lenticels; often smaller and occasionally a shrub. **Bark** gray slightly tinged with red and covered with small closely appressed scales.

Distribution. Florida, banks of streams and borders of the Everglades, near Little River to the Everglade keys, Dade County; on the Bahama Islands and in Jamaica.

XXIII. LEGUMINOSÆ.

Trees or shrubs, with alternate usually compound leaves, regular or papilionaceous usually perfect flowers; stamens 10 or indefinite, with diadelphous or distinct filaments and 2-celled anthers, the cells opening longitudinally; ovary superior, 1 or many-celled, inserted on the bottom of the calyx. Fruit a legume. Of the four hundred and thirty genera of the Pea-family now recognized and widely distributed in all temperate and tropical regions, eighteen have arborescent representatives in the United States.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT GENERA.

Subfamily 1. MIMOSOIDEÆ. Calyx 4–6-toothed, the teeth valvate in the bud; petals as many as the teeth of the calyx, valvate in the bud; ovules numerous, suspended in 2 ranks from the inner angle of the ovary, superposed, anatropous, the micropyle superior; stamens much exserted; leaves twice pinnate; cotyledons oval or orbicular, flat; radicle straight.

Stamens numerous (more than 10); seeds without albumen.

Filaments more or less united into a tube.

Filaments united.

Valves of the legume not separating at maturity from the margins. **1. Pithecolobium.**

Valves of the legume separating at maturity from the persistent margins. **2. Lysiloma.**

Filaments free or the inner ones slightly united at base. **3. Acacia.**

Stamens 10; filaments free; seeds with albumen.

Legume plano-compressed, dehiscent; flowers in globose heads. **4. Leucæna.**

Legume terete or compressed, indehiscent; flowers in cylindric spikes. **5. Prosopis.**

Subfamily 2. CÆSALPINIOIDÆ. Calyx 5-lobed or toothed, the divisions usually valvate in the bud; corolla imperfectly papilionaceous or nearly regular; petals 5, imbricated in the bud, the upper petal inside and inclosed by the others; stamens 10 or less; filaments free; anthers introrse; ovules numerous (*sometimes 2 in one species of Gleditsia*), superposed, anatropous, the micropyle superior; seeds albuminous.

Flowers imperfectly papilionaceous; calyx 5-toothed; legume flat, wing-margined; leaves simple. **6. Cercis.**

Flowers regular.

Flowers polygamous or diœcious.

Calyx-tube elongated, 5-lobed; petals 5; stamens 10, shorter than the petals; legume thick and woody; leaves twice pinnate. **7. Gymnocladus.**

Calyx-tube short, 3–5-lobed; petals 3–5; stamens 3–5, longer than the petals; legume leathery; leaves once and twice pinnate. **8. Gleditsia.**

Flowers perfect.

Legume linear, torulose, acuminate at the ends, the valves contracted between the seeds; rachis of the leaf spinescent. **9. Parkinsonia.**

Legume oblong, compressed; rachis of the leaf not spinescent. **10. Cercidium.**

Subfamily 3. PAPILIONATÆ. Calyx of 5 more or less united sepals; corolla of 5 irregular petals, papilionaceous, the upper petal (*standard*) larger than the others and inclosing them in the bud, usually turned backward or spreading, the 2 lateral petals (*wings*) oblong, exterior to the 2 lower connivent more or less united petals (*keel*) inclosing the stamens and pistil; stamens 10, 9 of them united into a tube cleft on the upper side, the 10th and upper stamen separate, or all distinct; ovary 1 or many-celled by cross partitions; ovules amphitropous, the micropyle superior; seeds usually without albumen; leaves once pinnate.

Stamens distinct.
Flowers in racemes; legume terete, contracted between the seeds. 11. **Sophora.**
Flowers in panicles; legume compressed. 12. **Cladrastis.**
Stamens diadelphous (9 and 1).
Flowers in racemes.
Leaves glandular-dotted.
Leaves many-foliolate; petals free and distinct. 13. **Eysenhardtia.**
Leaves simple; wings and keel-petals adnate to the tube of the stamens. 14. **Dalea.**
Leaves without glandular dots.
Legume compressed; stipules becoming spinescent, persistent. 15. **Robinia.**
Legume turgid, the valves unequally convex by the growth of the seeds.
Leaves 10–15-foliolate, without stipules or stipels; petals purple or violet. 16. **Olneya.**
Leaves 3-foliolate, with minute stipules and gland-like stipels; petals usually scarlet. 17. **Erythrina.**
Flowers in axillary panicles; pod linear, longitudinally 4-winged. 18. **Ichthyomethia.**

1. PITHECOLOBIUM Mart.

Trees or shrubs, with slender branches armed with the persistent spinescent stipules. Leaves petiolate, bipinnate, the pinnæ few-foliolate, their rachis generally marked by numerous glands between the pinnæ and between the leaflets. Flowers perfect or polygamous, from the axils of minute bracts, in pedunculate globose heads or oblong cylindric spikes, their peduncles in terminal panicles or axillary fascicles; calyx campanulate, short-toothed; corolla funnel-shaped, the petals as many as the teeth of the calyx, joined for more than half their length; stamens numerous, united at base into a tube free from the corolla; anthers minute, versatile; ovary stipitate, contracted into a slender filiform style, with a minute terminal stigma. Legume compressed, 2-valved, dehiscent, the valves continuous or interrupted within. Seeds compressed, suspended transversely; funicle filiform or expanded into a fleshy aril; hilum near the base of the seed; seed-coat thin or thick, marked on each of the 2 surfaces of the seed by a faint oval ring or oblong depression; embryo filling the cavity of the seed; the radicle included or slightly exserted.

Pithecolobium with more than a hundred species is widely distributed through the tropical and subtropical regions of the two worlds, and is most abundant in tropical America. Of the four species found within the territory of the United States three are arborescent.

The generic name, from *πίθηξ* and *ἑλλόβιον*, relates to the contorted fruit of some of the species.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT SPECIES.

Pinnæ with 1 pair of leaflets; valves of the legume much **contorted** after opening; seed surrounded by the enlarged ariloid funicle. 1. **P. unguis-cati** (D).
Pinnæ with more than 1 pair of leaflets; valves of the legume not contorted after opening; funicle of the seed not enlarged and ariloid.
Pinnæ with 3–5 pairs of leaflets; legume short-stalked, the valves submembranaceous; seeds not in separate compartments. 2. **P. brevifolium** (E).
Pinnæ with 2–3 pairs of leaflets; legume sessile, the valves thick and woody, tardily dehiscent; seeds in separate compartments. 3. **P. flexicaule** (E).

1. Pithecolobium unguis-cati Mart. Cat's Claw.

Zygia Unguis-Cati Sudw.

Leaves persistent, long-petiolate, with a single pair of bifoliolate pinnæ and a slender petiole ½′–1′ long and slightly and abruptly enlarged at base; rachis glandular between

the short stout petiolules and between the orbicular or broad-oblong leaflets, rounded and rarely emarginate at apex, rounded on one side and cuneate on the other of the oblique base, entire, thin or somewhat coriaceous, reticulate-veined, bright green and lustrous on the upper surface and paler on the lower surface, ½′–2′ long, and ½′–1½′ wide. **Flowers** polygamous, pale yellow, glabrous or slightly puberulous, opening in Florida in March and continuing to appear until midsummer, in globular heads on slender peduncles 1′–1½′ long fascicled in the axils of upper leaves or collected in ample terminal panicles, their bracts lanceolate, acuminate, chartaceous, ¼′ long, caducous; calyx rather less than ½′ long, broadly toothed, one quarter as long as the acuminate petals barely exceeding the tube formed by the union of the filaments; stamens purple, ½′ long; ovary glabrous, long-stalked, minute or rudimentary in the sterile flower. **Fruit** slightly torulose, stipitate, rounded or acute at apex, 2′–4′ long, ¼′–½′ wide, the valves reticulate-veined, thickened on the margins, bright reddish brown and after opening greatly and variously contorted; **seeds** irregularly obovoid or sometimes nearly triangular, compressed or thickened, dark chestnut-brown, lustrous, marked by faint oval rings, ⅓′ long, surrounded at base by the enlarged bright red ariloid funicle; seed-coat thin, cartilaginous.

A tree, sometimes 20°–25° high, with a slender trunk 7′–8′ in diameter, ascending and spreading branches forming a low flat irregular head, and slender somewhat zigzag branchlets slightly striately angled when they first appear, becoming terete, light gray-brown or dark reddish brown, covered with minute pale lenticels, and armed with the straight persistent rigid stipular spines broad at base and ¼′ long, or rarely minute; more often a shrub,

Fig. 538

with many vine-like almost prostrate stems. **Bark** of the trunk ¼′ thick, reddish brown and divided by shallow fissures into small square plates. **Wood** very heavy, hard, close-grained, rich red varying to purple, with thin clear yellow sapwood. The bark is astringent and diuretic, and was once used in Jamaica as a cure for many diseases.

Distribution. Florida, Captive and Sanibel Islands and Caloosa, Lee County to the southern keys; most abundant in its arborescent form on the larger of the eastern keys, and probably of its largest size in Florida on Elliott's Key; often forming shrubby thickets; on the Bahamas, and common and widely distributed through the Antilles to Venezuela and New Granada.

2. Pithecolobium brevifolium Benth. Huajillo.

Zygia brevifolia Sudw.

Leaves 2′–3′ long, 2′ wide, with eight to ten 10–20-foliolate pinnæ and slender terete petioles 1′ in length and furnished near the middle with a dark oblong gland, when they

unfold coated with pale tomentum and at maturity glabrous with the exception of the puberulous petiole and rachis; persistent or tardily deciduous; leaflets oblong-linear, obtuse or acute at apex, oblique at base, very short-petiolulate, light green on the upper surface, paler on the lower surface, $\frac{1}{6}'$–$\frac{1}{4}'$ long. **Flowers** white to violet-yellow, in globose or oblong heads

Fig. 539

$\frac{1}{2}'$ in diameter, on thin pubescent peduncles bracteolate at apex, coated at first, like the flower-buds, with thick white tomentum, developed usually in pairs from the axils of lanceolate acute scarious deciduous bracts, and arranged in short terminal racemes; calyx shortly 5-lobed, puberulous on the outer surface, about $\frac{1}{2}\frac{1}{4}'$ long and one fourth the length of the puberulous petals persistent with the stamens at the base of the mature legume; stamens nearly $\frac{1}{2}'$ long. **Fruit** ripening at midsummer and often persistent on the branches after opening until the trees flower the following year, straight, slightly torulose, short-stalked, contracted at apex into a short slender point, 4′–6′ long and $\frac{2}{3}'$ wide, its valves thin, thick-margined, reddish brown on the outer surface, yellow tinged with red on the inner surface, reticulate-veined; **seeds** suspended by a slender coiled and somewhat dilated funicle, compressed, ovoid to nearly orbicular, dark chestnut-brown, very lustrous, $\frac{1}{4}'$ long, and faintly marked by large oval depressions; seed-coat thin, cartilaginous.

A tree, 25°–30° high, with a trunk rarely 5′–6′ in diameter, slender upright branches forming a narrow irregular head, and branchlets slightly striately angled, covered with minute white lenticels, light gray and puberulous when they first appear, becoming dark brown in their second year, and armed with stout rigid stipular spines sometimes $\frac{1}{2}'$ long and persistent for many years; more often a shrub, sometimes only 2°–3° tall. **Bark** of the trunk smooth, light gray somewhat tinged with red, and often marked by large pale blotches. **Wood** dark-colored, hard, and heavy.

Distribution. Bluffs and bottom-lands of the lower Rio Grande, and on the upper Nueces River in Uvalde County, Texas; usually a low shrub spreading into broad clumps, but occasionally in the rich and comparatively moist soil of the banks of river-lagoons a slender tree; in Mexico more abundant, and of its largest size from the mouth of the Rio Grande to the Sierra Madre of Nuevo Leon.

3. Pithecolobium flexicaule Coult. Ebony.

Zygia flexicaulis Sudw.

Leaves persistent, $1\frac{1}{2}'$–$2'$ long, $2\frac{1}{2}'$–$3'$ wide, long-petiolate with slender puberulous petioles glandular near the middle and furnished at apex with small orbicular solitary glands, and 4–6 usually 6-foliolate pinnæ, the lowest pair often the shortest; leaflets

oblong-ovate, rounded at apex, reticulate-veined, thin or subcoriaceous, glabrous, dark green and lustrous on the upper surface, paler on the lower surface, $\frac{1}{4}'$–$\frac{1}{3}'$ long; petiolules short and broad. **Flowers** light yellow or cream color, very fragrant, sessile in the axils of minute caducous bracts, appearing from June until August, in cylindric dense or interrupted spikes $1\frac{1}{2}'$ long, on stout pubescent peduncles fascicled in the axils of the upper leaves of the previous year; corolla four or five times as long as the calyx and like it puberulous on the outer surface, and about as long as the tube formed by the union of the filaments; stamens $\frac{3}{8}'$ long; ovary glabrous, sessile. **Fruit** ripening in the autumn and remaining on the branches until after the flowering season of the following year, sessile, tardily dehiscent, thick, straight or slightly falcate, oblique at base, rounded and contracted into a short broad point at apex, pubescent, 4′–6′ long and $1'$–$1\frac{1}{4}'$ wide, with thick

Fig. 540

woody valves lined with a thick pithy substance inclosing and separating the seeds; seeds suspended on a very short straight funicle, bright red-brown, $\frac{1}{2}'$ long and $\frac{1}{4}'$ wide, irregularly obovoid, faintly marked by short oblong depressions; seed-coat thick, crustaceous.

A tree, 20°–30° high, with a straight trunk 2°–3° in diameter, separating 8°–10° from the ground into short spreading branches forming a wide round head, and stout zigzag branchlets, puberulous, light green or dark reddish brown when they first appear, becoming in their second year glabrous or rarely puberulous, dark reddish brown or light gray, and armed with the persistent stipular pale chestnut-brown spines $\frac{1}{4}'$–$\frac{1}{2}'$ long. **Wood** exceedingly heavy, hard, compact, close-grained, dark rich red-brown slightly tinged with purple, with thin clear bright yellow sapwood; almost indestructible in contact with the ground and largely used for fence-posts; valued by cabinet-makers and for fuel, and considered more valuable than that of any other tree of the lower Rio Grande valley. The seeds are palatable and nutritious, and are boiled when green or roasted when ripe by the Mexicans, who use their thick shells as a substitute for coffee.

Distribution. Shores of Matagorda Bay, Texas, to the Sierra Nevada of Nuevo Leon, and in Lower California; common on the bluffs of the Gulf-coast and on both banks of the lower Rio Grande; south of the Rio Grande one of the commonest and most beautiful trees of the region.

2. LYSILOMA Benth.

Trees or shrubs, with slender unarmed branchlets, abruptly bipinnate long-petiolate persistent leaves, their petioles marked by large conspicuous glands, and small leaflets in many pairs; stipules large, membranaceous, persistent or deciduous. Flowers perfect

or rarely polygamous, minute, usually white or greenish white, from the axils of minute bractlets more or less dilated at apex, in globose many-flowered heads, on axillary solitary or fascicled peduncles; calyx campanulate, 5-toothed; corolla funnel-shaped, of 5 petals united for more than half their length; stamens generally 12–30, exserted; filaments filiform, united at base into a tube free from the corolla; anthers minute, ovoid, versatile; ovary sessile, contracted into a slender subulate style, with a minute terminal stigma. Legume broad, straight, compressed, submembranaceous, the valves at maturity separating from the undivided margins, continuous within, their outer layer thin and papery, dark-colored, the inner rather thicker, pale yellow. Seeds compressed, transverse, suspended by a long slender funicle, the hilum near the base; seed-coat thin, crustaceous; radicle slightly exserted.

Lysiloma with about ten species inhabits tropical America from southern Florida and the Bahama Islands, the West Indies, Mexico and Lower California, to Central America and Bolivia. Several of the species produce valuable timber.

The generic name, from λύσις and λῶμα, refers to the separation of the valves from the margins of the legume.

1. Lysiloma bahamensis Benth. Wild Tamarind.

Leaves 4′–5′ long, glabrous or sometimes slightly puberulous, with slender petioles 1′ long, marked near the middle with an elevated gland, enlarged and slightly glandular at base, and 2–6 pairs of short-stalked 40–80-foliolate pinnæ; stipules foliaceous, ovate or ovate-oblong, acuminate, auriculate and semicordate at base, ½′ long, usually caducous; leaflets obliquely ovate or oblong, obtuse or acute, more or less united at base by the greater development of one of the sides, sessile or short-petiolulate, entire, reticulate-veined, light green, paler on the lower than on the upper surface, ¼′–½′ long, and ⅛′–¼′ wide. **Flowers** about ⅓′ long, in heads appearing in Florida early in April, coated before the flowers open with thick pale tomentum, and after the exsertion of the stamens ⅔′ in diameter, on peduncles ¾′–1½′ long, solitary or fascicled in the axils of upper

Fig. 541

leaves, their bracts and bractlets acute, membranaceous, caducous; calyx 5-toothed, pilose on the outer surface, especially above the middle, 1/12′ long, and half as long as the 5-lobed corolla with reflexed lobes; stamens about 20, twice as long as the corolla, united for one fourth of their length into a slender tube. **Fruit** ripening in the autumn and persistent on the branches until after the flowering period of the following year, stipitate, gradually narrowed and acute at the ends, 4′–5′ long, 1′ broad, with a slender stem 1′–

2′ long, in clusters of 2 or 3 on short peduncles abruptly and conspicuously enlarged at the apex; valves thin and papery, bronze-green when fully grown, becoming dark red-brown, separating slowly from the margins; seeds oval or obovoid, dark brown, lustrous, ½′ long.

A tree, 50°–60° high, with a trunk 2°–3° in diameter, stout spreading branches forming a wide flat head, and glabrous or somewhat pilose conspicuously verrucose branchlets, bright red-brown when they first appear, becoming pale or light reddish brown in their second year. **Bark** of the trunk of young trees and of the branches smooth, light gray tinged with pink, becoming on old trunks ¼′–½′ thick, dark brown and separating into large plate-like scales. **Wood** heavy, hard, not strong, tough, close-grained, rich dark brown tinged with red, with nearly white sapwood 1′–1½′ thick, of 4 or 5 layers of annual growth; in Florida occasionally used and valued for boat and shipbuilding.

Distribution. Florida; shores of Bay Biscayne near Miami, and the Everglade Keys, Dade County, common, and on Key Largo, Elliott's, Plantation, and Boca Chica Keys, not common; on the Bahama Islands and in Cuba.

3. ACACIA Adans.

Trees or shrubs, with slender branches armed with spinescent stipules or infrastipular spines. Leaves alternate on young branchlets and fascicled in earlier axils, bipinnate, with usually small leaflets, persistent. Flowers perfect or polygamous, small, in the axils of minute linear bractlets more or less dilated and often peltate at apex, in globose heads or cylindric spikes on axillary solitary or fascicled peduncles; calyx campanulate, 5 or 6-toothed; petals as many as the divisions of the calyx, more or less united; stamens numerous, usually more than 50, exserted, free or slightly and irregularly united at base, inserted under or just above the base of the ovary; filaments filiform; anthers small, attached on the back, versatile; ovary contracted into a long slender style terminating in a minute stigma. Legume nearly cylindric or flat, indehiscent, continuous or divided within. Seeds transverse, compressed; seed-coat thick, crustaceous, marked on each face of the seed by an oval depression or ring; radicle straight, included, or slightly exserted.

Acacia with more than four hundred species is widely distributed through Australia, where it is most largely represented, tropical and southern Africa, northern Africa, southwestern China, the warmer regions of southern Asia, the islands of the south Pacific, tropical and temperate South America, the West Indies, Central America and Mexico to the southwestern boundaries of the United States where ten or twelve species occur; of these five are arborescent. Acacia is astringent, and many species yield valuable tan bark. Gum arabic is produced by different Old World species; many of the species yield hard heavy durable wood, and some of the Australian Acacias are large and valuable timber-trees. Many species are cultivated for their graceful foliage and handsome fragrant flowers.

The generic name, from *ἀκακία*, relates to the spines with which the branches are usually armed.

CONSPECTUS OF THE ARBORESCENT SPECIES OF THE UNITED STATES.

Flowers in globose heads; corolla 5-lobed; ovary sessile; stipules persistent, becoming spines.

Legume cylindric, glabrous, its sutures conspicuously thickened and grooved; seeds in 2 ranks. 1. **A. Farnesiana** (E).

Legume flattened, pubescent, its sutures not thickened, slightly grooved; seeds in 1 rank. 2. **A. tortuosa** (E).

Flowers in short, often interrupted, spikes; legume flattened, pubescent, its sutures thickened; seeds in one rank. 3. **A. Emoriana** (E).

Flowers in elongated slender spikes; corolla of 5 petals only slightly united at base; ovary stalked; stipules caducous; branchlets armed with infrastipular spines.

Legume 1′–1¼′ wide, straight or slightly contracted between the seeds, not becoming twisted and contorted at maturity; seeds narrow-obovoidor ovoid; leaflets green, glabrous, with prominent veinlets. 4. **A. Wrightii** (E).

Legume ½′–¾′ wide, often conspicuously contracted between the seeds, becoming twisted and contorted at maturity; seeds nearly orbicular; leaflets blue-green, pubescent, with obscure veinlets. 5. **A. Greggii** (E, G, H).

1. Acacia Farnesiana Willd. Huisache. Cassie.

Leaves 2′–4′ long, with 2–8, usually 4 or 5, pairs of pinnæ, generally somewhat puberulous on the short petiole and rachis; in Texas mostly falling at the beginning of winter; pinnæ sessile or short-stalked, remote or close together, with 10–25 pairs of linear acute

Fig. 542

leaflets tipped with a minute point, unequal at base, sessile or short-petiolulate, glabrous or puberulous, bright green, ⅛′–¼′ long. **Flowers** bright yellow, very fragrant, 1/16′ long, opening during the summer and autumn from the axils of minute clavate pilose bractlets, in heads ⅔′ in diameter, on axillary thin puberulous peduncles, solitary or most often 2 or 3 together and 1′–1½′ in length, with two minute dentate connate bracts forming an involucral cup immediately under the flower-head; calyx about half as long as the petals and like them somewhat pilose on the outer surface; stamens two or three times as long as the corolla; ovary short-stipitate, covered with long pale hairs. **Fruit** oblong, cylindric or spindle-shaped, thick, turgid, straight or curved, slightly contracted between the seeds, short-stalked, narrowed at apex into a short thick point, 2′–3′ long, ½′–⅔′ broad, dark red-purple, lustrous, and marked by broad light-colored bands along the thickened grooved sutures, the outer coat of the walls thin and papery, inclosing a thick pithy pulp-like substance surrounding the seeds, each in a separate thin-walled compartment; **seeds** ovoid, thick, flattened on the inner surface by mutual pressure, ¼′ long, suspended transversely in 2 ranks on a short straight funicle, light brown, lustrous, and faintly marked by large oval rings.

A tree, 20°–30° high, with a straight trunk 12′–18′ in diameter, separating 6°–8° from the ground into numerous long pendulous branches forming a wide round spreading head, and slender terete or slightly striate angled branchlets, glabrous or at first puberulous, and armed with straight rigid terete spines developed from the persistent stipules and sometimes 1½′ long. **Bark** of the trunk thin, reddish brown, irregularly broken by long reticulated ridges, exfoliating in large thin scales. **Wood** heavy, hard, close-grained, rich reddish brown, with thin pale sapwood; in India used for the knees of small vessels and in agricultural implements.

Distribution. Now widely spread by cultivation through the tropical and subtropical regions of the two worlds and probably a native of America from western Texas to northern Chili; growing in Texas apparently naturally in the arid and almost uninhabited region between the Nueces and Rio Grande; naturalized and now covering great areas in the valley of the Guadalupe River near Victoria, Victoria County, Texas.

Largely cultivated in southern Europe for its fragrant flowers used in the manufacture of perfumery, as an ornament of gardens in all warm countries, and in India as a hedge plant.

2. Acacia tortuosa Willd.

Leaves generally less than 1′ long, short-petiolate, with a slender puberulous rachis and usually 3 or 4 pairs of pinnæ; early deciduous; pinnæ sessile or short-stalked, remote, with 10–15 pairs of linear somewhat falcate leaflets, acute, tipped with a minute point, subsessile, light green, glabrous, $\frac{1}{20}'$–$\frac{1}{16}'$ long. **Flowers** minute, bright yellow, very fragrant, in the axils of clavate pilose bracts, in heads $\frac{1}{4}'$–$\frac{3}{8}'$ in diameter, appearing in March with or just before the unfolding leaves, on clustered or solitary slender puberulous peduncles $\frac{1}{2}'$–$\frac{3}{4}'$ long, and furnished at apex with 2 minute connate bracts; calyx only about one third as long as the corolla, with short puberulous lobes; corolla puberulous at apex, less than half as long as the filaments; ovary covered with short close pubescence. **Fruit** elongated, linear, slightly compressed, somewhat constricted between the seeds, dark red-brown and cinereo-puberulous, 3′–5′ long and about $\frac{1}{4}'$ wide; **seeds** in 1 series, obovoid, compressed, dark red-brown, lustrous, about $\frac{1}{4}'$ long, faintly marked by large oval rings.

A tree, occasionally 15°–20° high, with a straight trunk 5′–6′ in diameter, stout wide-spreading branches forming an open irregular head, and slender somewhat zigzag slightly angled reddish brown branchlets roughened by numerous minute round lenticels, villose with short pale hairs, and armed with thin terete puberulous spines occasionally $\frac{3}{4}'$ long; in Texas usually shrubby, with numerous stems forming a symmetric round-topped bush only a few feet high. **Bark** dark brown or nearly black, and deeply furrowed.

Fig. 543

Distribution. Valley of the Rio Cibolo to Eagle Pass on the Rio Grande, Maverick County, Texas; and in northern and southern Mexico, the West Indies, Venezuela, and on the Galapagos Islands; in Texas probably arborescent only on the plains of the Rio Grande near Spofford, Kinney County.

3. Acacia Emoriana Benth.

Leaves $3\frac{1}{2}'$–4′ long, with a slender petiole and rachis, villose-pubescent early in the season, becoming nearly glabrous; and 4 or 5 pairs of pinnæ; falling late in the autumn;

pinnæ on slender stalks $\frac{1}{4}'$ in length, with 5–7 pairs of oblong leaflets rounded and apiculate at apex, obliquely rounded at base, short-petiolulate, pointing forward, when they unfold densely villose above and on the margins, and hoary-tomentose below, becoming glabrous, gray-green rather darker above than below, $\frac{1}{3}'$ long. **Flowers** subsessile, puberulous, in interrupted spikes, $\frac{3}{4}'$–$1'$ in length, densely hoary-tomentose when they first appear late in March, on villose peduncles $\frac{1}{2}'$–$1'$ in length, and furnished near the apex with lanceolate caducous bracts; calyx about half the length of the ovate acute petals ciliate on the margins, about $\frac{1}{12}'$ long and much shorter than the stamens; ovary stipitate, glabrous. **Fruit** fully grown in July, stipitate much compressed, rounded and sometimes slightly emarginate at apex, gradually narrowed and obliquely cuneate at base, with much thickened revolute undulate margins, densely pubescent early in the season, becoming puberulous,

Fig. 544

5′ or 6′ long, $1\frac{1}{4}'$–$1\frac{1}{2}'$ wide and many-seeded, or nearly orbicular and 1 or 2-seeded; **seeds** in one series, oval, the two sides unsymmetric, obliquely pointed at base, rounded at apex, compressed, dark chestnut-brown and lustrous, $\frac{1}{2}'$ long and $\frac{1}{4}'$ wide.

A tree, sometimes 25° high, usually smaller, with slender red-brown branchlets pubescent or puberulous when they first appear, becoming glabrous in their second year, and armed with small curved stipular spines; often a shrub.

Distribution. Texas; creek banks and cañons, near Montell and Uvalde, Uvalde County, and rocky banks of Devil's River, Valverde County (*E. J. Palmer*).

4. Acacia Wrightii Benth. Cat's Claw.

Leaves 1′–2′ long, slightly pubescent, especially on the petiole and rachis, with 1–3 pairs of pinnæ, slender petioles $1\frac{1}{2}'$ in length, and eglandular or glandular with small convex glands, and linear acute caducous stipules $\frac{1}{16}'$ long; pinnæ short-stalked, with 2–5 pairs of obovate-oblong leaflets, obliquely rounded and often apiculate at apex, sessile or short-petiolulate, 2 or sometimes 3-nerved, glabrous, or rarely pubescent, reticulate-veined, rigid, bright green and rather paler on the lower surface than on the upper surface, $\frac{1}{4}'$–$\frac{5}{8}'$ long. **Flowers** light yellow, fragrant, appearing from the end of March to the end of May, on slender pubescent pedicels from the axils of minute caducous bracts, in narrow spikes $1\frac{1}{2}'$ long, often interrupted below the middle, on slender fascicled pubescent or sometimes glabrous peduncles; calyx obscurely 5-lobed, pubescent on the outer surface, half as long as the spatulate petals slightly united at base, and ciliate on the margins; stamens $\frac{1}{4}'$ long; ovary long-stalked, covered with long pale hairs. **Fruit** fully grown

early in the summer, deciduous in the autumn, slightly falcate, compressed, stipitate, oblique at base, rounded and short-pointed at apex, 2′–4′ long, 1′–1¼′ wide, with thick straight or irregularly contracted margins and thin papery walls conspicuously marked by narrow horizontal reticulate veins; **seeds** narrow-obovoid, compressed, ¼′ long, suspended transversely on a long slender funicle, light brown, marked by large oval depressions.

A tree, occasionally 25°–30° high, with a short trunk 10′–12′ in diameter, spreading branches forming a low wide or irregular head, and branchlets when they first appear somewhat striately angled, glabrous, pale yellow-brown or dark red-brown, turning pale gray in their second year, and armed with occasional stout recurved infrastipular chestnut-brown spines ¼′ long, compressed toward the broad base and sharp-pointed, or rarely unarmed. **Bark** of the trunk about ⅛′ thick, divided by shallow furrows into broad

Fig. 545

ridges separating on the surface into thin narrow scales. **Wood** very heavy, hard, close-grained, bright clear brown streaked with red and yellow, with thin clear yellow sapwood of 6 or 7 layers of annual growth; valued and largely used as fuel.

Distribution. Valley of the Guadalupe River in the neighborhood of New Braunfels, Comal County, Texas, to the Sierra Madre of Nuevo Leon; most abundant and of its largest size south of the Rio Grande on dry gravelly mesas and foothills.

5. Acacia Greggii A. Gray. Cat's Claw. Una de Gato.

Leaves 1′–3′ long, pubescent or puberulous, with 1–3 pairs of pinnæ, a short slender petiole furnished near the middle with a minute oblong chestnut-brown gland, and linear caducous stipules $\frac{1}{10}$′ long; pinnæ short-stalked, with 4–5 pairs of obovate oblique leaflets rounded or truncate at apex and unequally contracted at base into a short petiolule, thick and rigid, 2–3-nerved, inconspicuously reticulate-veined, hoary-pubescent, $\frac{1}{16}$′–¼′ long. **Flowers** fragrant, bright creamy yellow, in dense oblong pubescent spikes, on a peduncle ½′–⅔′ long, and fascicled usually 2 or 3 together toward the end of the branches; calyx obscurely 5-lobed, puberulous on the outer surface, half as long as the petals slightly united at base and pale-tomentose on the margins; stamens ¼′ long; ovary long-stalked, covered with long pale hairs. **Fruit** fully grown at midsummer and hanging unopened on the branches until winter or the following spring, compressed, straight or slightly falcate, obliquely narrowed at base into a short stalk, acute or rounded at apex, more or less contracted between the seeds, 2′–4′ long, ½′–¾′ wide, curling and often contorted when fully ripe, the valves thin and membranaceous, thick-margined, light brown, conspicuously transversely reticulate-veined; **seeds** nearly orbicular, compressed, dark brown and lustrous, ¼′ in diameter, marked by small oval depressions.

A tree, rarely 30° high, with a trunk 10′–12′ in diameter, numerous spreading branches, and striately angled puberulous or in Texas glabrous pale brown branchlets faintly tinged with red and armed with stout recurved infrastipular spines flat at base, and ¼ long and broad. **Bark** of the trunk about ⅛′ thick, furrowed, the surface separating into thin nar-

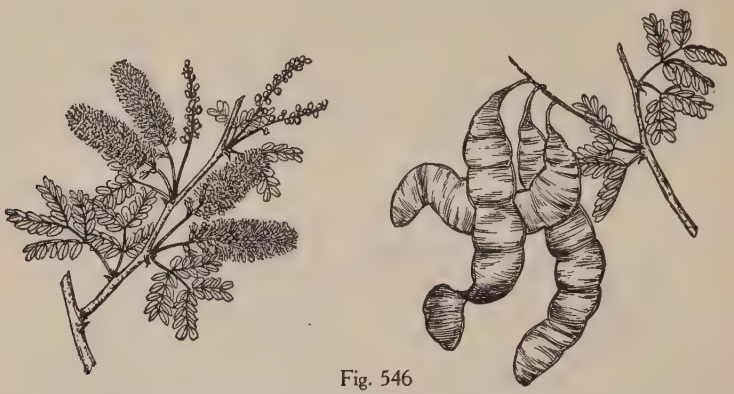

Fig. 546

row scales. **Wood** heavy, very hard, strong, close-grained, durable, rich brown or red, with thin light yellow sapwood of 5 or 6 layers of annual growth.

Distribution. Dry gravelly mesas, the sides of low cañons and the banks of mountain streams; valley of the Rio Grande, western Texas, through southern New Mexico and Arizona to southern California, ranging northward in Arizona to the rim of the Grand Cañon of the Colorado River, and to Clark County, Nevada; in northern Mexico, and in Lower California to the eastern base of the San Pedro Mártir Mountains.

4. LEUCÆNA Benth.

Trees or shrubs, with slender unarmed branches. Leaves persistent, abruptly bipinnate, with numerous pinnæ and small leaflets in many pairs, petiolate, the petioles often furnished with a conspicuous gland below the lower pair of pinnæ; stipules minute and caducous, or becoming spinescent and persistent. Flowers minute, white, mostly perfect, sessile or short-pedicellate, in the axils of small peltate bracts villose at apex, in globose many-flowered pedunculate heads, the peduncles in axillary fascicles or in leafless terminal racemes; calyx tubular-campanulate, minutely 5-toothed; petals 5, free, acute or rounded at apex, narrowed at base; stamens 10, free, inserted under the ovary, exserted; filaments filiform; anthers oblong, versatile; ovary stipitate, contracted into a long slender style, with a minute terminal slightly dilated stigma. Legume many-seeded, stipitate, linear, compressed, dehiscent, the valves thickened on the margins, rigid, thin, continuous within, their outer coat thin and papery, dark-colored, the inner rather thicker, woody, pale brown. Seeds obovoid, compressed, transverse, the hilum near the base, suspended on a long slender funicle; seed-coat thin, crustaceous, brown and lustrous; embryo inclosed on its two sides by a thin layer of horny albumen; radicle slightly exserted.

Leucæna with nine or ten species is confined to the warmer parts of America from western Texas to Venezuela and Peru, and to the islands of the Pacific Ocean from New Caledonia to Tahiti, where one species has been recognized. Of the indigenous species found in the territory of the United States, three are arborescent. *Leucæna glauca* L., a small tree or shrub, cultivated in all warm countries, and a native probably of tropical America, is now naturalized on Key West, Florida.

The generic name, from λευχαίνω, refers to the color of the flowers.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Peduncles bibracteolate at apex; stipules becoming spinescent.
Leaves 10–14-pinnate; pinnæ with 15–30 pairs of leaflets; blade of the bract of the flower produced into a short point. **1. L. Greggii** (E).
Leaves 2–4-pinnate; pinnæ with 4–8 pairs of leaflets; blade of the bract of the flower produced into a long slender villose tip. **2. L. retusa** (E).
Peduncles without bracts; stipules minute, caducous; leaves 30–36-pinnate; pinnæ with 30–60 pairs of leaflets. **3. L. pulverulenta** (E).

1. Leucæna Greggii S. Wats.

Leaves 6′–7′ long and broad, with a slender rachis furnished on the upper side with a single elongated bottle-shaped gland between the stalks of each pair of pinnæ; pinnæ 10–14, remote, short-stalked, with 15–30 pairs of leaflets; stipules gradually narrowed into a long slender point, becoming rigid and spinescent, $\frac{1}{3}$′ to nearly $\frac{1}{2}$′ long and persistent for two or three years; leaflets lanceolate, acute or acuminate, often somewhat falcate, nearly sessile or short-petiolulate, full and rounded toward the base on the lower margin, nearly straight on the upper margin, gray-green, ultimately nearly glabrous, $\frac{1}{4}$′–$\frac{1}{3}$′ long, about $\frac{1}{8}$′ wide, with a narrow midvein and obscure lateral nerves. **Flowers** on slender pedicels, in heads $\frac{3}{4}$′–1′ in diameter, on stout peduncles 2′–3′ long furnished at apex with 2 irregularly 3-lobed bracts, and solitary or in pairs; calyx coated with hairs only near the apex, much shorter than the spatulate glabrous more or less boat-shaped petals; ovary villose with a few short scattered hairs. **Fruit** 6′–8′ long, $\frac{1}{3}$–$\frac{1}{2}$′ wide, narrowed below into a short stout stipe, acuminate and crowned at apex with the thickened style, $\frac{1}{3}$′–$\frac{3}{4}$′ long,

Fig. 547

cinereo-pubescent until nearly fully grown, becoming nearly glabrous at maturity, much compressed, with narrow wing-like margins; **seeds** conspicuously notched by the hilum, $\frac{1}{2}$′ long and $\frac{1}{3}$′ wide.

A tree, 15°–20° high, with a stem 4′–5′ in diameter, and stout zigzag red-brown branchlets marked by numerous pale lenticels, coated at first with short spreading lustrous yellow deciduous hairs found also on the young petioles and lower surface of the unfolding leaflets, the peduncles of the flower-heads and their bracts. **Bark** about $\frac{3}{8}$′ thick, dark brown, divided into low ridges and broken on the surface into small closely appressed persistent scales. **Wood** heavy, hard, close-grained, rich brown streaked with red, with thin clear sapwood.

Distribution. Mountain ravines and the steep banks of streams; western Texas from the valley of the upper San Saba River to that of Devil's River; and southward into Mexico.

2. Leucæna retusa Benth.

Leaves 3′ or 4′ long and 4′ or 5′ wide, with a slender petiole and rachis and 2–4 pairs of pinnæ 6′–10′ long, remote, long-stalked, with 4–8 pairs of short-stalked leaflets furnished between their stems with a single globose white gland found also occasionally on the upper side of the rachis between the stems of the pinnæ; stipules ovate, gradually narrowed into a long slender tip, $\frac{1}{2}$′ in length, often persistent through the season; leaflets obliquely obovate or elliptic, rounded and apiculate at apex, obliquely rounded or cuneate at the unsymmetric base, entire, short-petiolulate, villose-pubescent like the rachis and petiole when they first appear, soon glabrous, and at maturity thin, blue-green, $\frac{3}{4}$′–1′ long and $\frac{1}{3}$′–$\frac{1}{2}$′ wide, with a slender midrib, and prominent veins extending obliquely toward the apex of the leaflet, those of the lowest pair more prominent and starting from near its base.

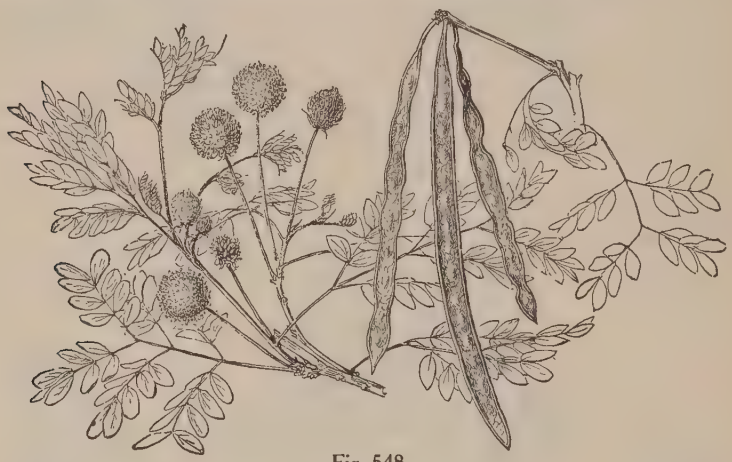

Fig. 548

Flowers short-stalked in the axil of a peltate bract, its blade produced into a long slender villose tip, appearing continuously from April until October in dense globose heads $\frac{3}{4}$′ in diameter, on villose bibracteolate axillary, single or fascicled peduncles 1$\frac{1}{2}$′–3′ in length; calyx thin, tubular, 5-toothed at apex; petals narrow-oblong, hardly longer than the calyx; stamens 10, shorter than the bract of the flower; anthers glabrous. **Fruit** solitary or clustered, on a puberulous peduncle 3′–5′ in length, 6′–10′ long, $\frac{1}{3}$′–$\frac{1}{2}$′ wide, gradually narrowed below into a stout stipe, the acuminate apex terminating in the thickened persistent style, glabrous and dark reddish brown; seeds $\frac{1}{3}$′ long and $\frac{1}{4}$′ wide.

A tree, occasionally 25° high, with a trunk 6′–8′ in diameter, and slender branchlets pubescent when they first appear, becoming puberulous and orange-brown or reddish brown at the end of their first season; more often a shrub.

Distribution. Texas; steep rocky hillsides, and on the summits of limestone bluffs; (Uvalde, Valverde, Kemble, Real and Jeff Davis Counties).

3. Leucæna pulverulenta Benth. Mimosa.

Leaves 4′–7′ long and 3′–4′ wide, with a slender petiole usually marked by a large dark oblong gland between the somewhat enlarged base and the lowest pair of the 30–36 nearly sessile crowded pinnæ, each with 30–60 pairs of leaflets, and minute caducous stipules, when they unfold covered like the peduncles and flower-buds with dense hoary tomentum, and at maturity puberulous on the petiole and rachis; leaflets linear, acute, rather oblique at base by the greater development of the upper side, sessile or very

short-petiolulate, pale bright green, $\frac{1}{8}'$–$\frac{1}{4}'$ long. **Flowers** sessile, fragrant, in heads $\frac{1}{2}'$ in diameter, appearing in succession as the branches grow from early spring to midsummer, on slender peduncles $1'$–$1\frac{1}{2}'$ long and fascicled in the axils of upper leaves; calyx one fourth as long as the acute petals and like them pilose on the outer surface; stamens twice as long as the petals; ovary coated with long pale hairs. **Fruit** conspicuously thick-margined, $4'$–$14'$ long, long-stalked, tipped with a short straight or recurved point, usually in pairs on a peduncle thickened at apex; **seeds** $\frac{5}{16}'$ long.

A tree, 50°–60° high, with a straight trunk $18'$–$20'$ in diameter, separating 20°–30° from the ground into slender spreading branches forming a loose round head, and branchlets at first more or less striately grooved and thickly coated with pulverulent caducous tomentum, becoming at the end of a few weeks terete, pale cinnamon-brown and puberulous. **Bark** about $\frac{1}{4}'$ thick, bright cinnamon-brown, and roughened by thick persistent

Fig. 549

scales. **Wood** heavy, hard, very close-grained, rich dark brown, with thin clear yellow sapwood of 2 or 3 layers of annual growth; considered valuable, and sometimes manufactured into lumber.

Distribution. Rich moist soil of river banks and the borders of lagoons and small streams; valley of the lower Rio Grande; in Texas only for a few miles near its mouth; more abundant from Matamoras to Monterey in Nuevo Leon; and southward to the neighborhood of the City of Mexico.

Occasionally planted as a shade and ornamental tree in the towns of the lower Rio Grande valley and in New Orleans, Louisiana.

5. PROSOPIS L. Mesquite.

Trees or shrubs, with branches without a terminal bud and armed with geminate supra-axillary persistent spines, and small obtuse axillary buds covered with acute apiculate dark brown scales. Leaves alternate on branches of the year and fascicled in earlier axils, deciduous, usually 2 rarely 3–4-pinnate, with many-foliolate pinnæ; petioles glandular at apex with a minute gland, and tipped with the small spinescent rachis; stipules linear, membranaceous or spinescent, deciduous. Flowers greenish white, nearly sessile, in axillary pedunculate spikes; calyx campanulate, 5-toothed, or slightly 5-lobed, deciduous; petals 5, connate below the middle or ultimately free, glabrous or tomentose on the inner surface toward the apex, sometimes puberulous on the outer surface; stamens 10, free, inserted with the petals on the margin of a minute disk adnate to the calyx-tube, those opposite the lobes of the calyx rather longer than the others; filaments filiform; anthers oblong, versatile, their connective tipped with a minute deciduous gland, the cells

opening by marginal sutures; ovary stipitate, villose; style filiform, with a minute terminal stigma. Legume linear, compressed or subterete, straight or falcate, or contorted or twisted into a more or less regular spiral, indehiscent; the outer coat thin, woody, pale yellow, inclosing a thick spongy inner coat of sweet pulp containing the seeds placed obliquely and separately inclosed, their envelopes forming nut-like joints. Seeds oblong, compressed, the hilum near the base; seed-coat crustaceous, light brown, lustrous; embryo surrounded by a layer of horny albumen; radicle short, slightly exserted.

Prosopis is distributed in the New World from southern Kansas to Patagonia, and in the Old World is confined to tropical Africa, and to southwestern and tropical Asia. Sixteen or seventeen species have been distinguished. Of the three species found in the territory of the United States two are small trees.

Prosopis produces hard durable wood, particularly valuable as fuel, and the pods are used as fodder.

The generic name is from *προσωπίς*, employed by Dioscorides as a name of the Burdock.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT SPECIES.

Legume compressed or ultimately convex; pinnæ 12–22-foliolate.
1. **P. juliflora** (C, E, G, H).

Legume thick, spirally twisted; pinnæ 10–16-foliolate. 2. **P. pubescens** (E, F, G, H).

1. Prosopis juliflora DC. Mesquite. Honey Locust.

Leaves with 2 or rarely 4 pinnæ, and slender terete petioles abruptly enlarged and glandular at base; stipules linear, acute, membranaceous, deciduous. **Flowers** appearing in successive crops from May to the middle of July, fragrant, about $\frac{1}{12}'$ long, on short

Fig. 550

pedicels, in slender cylindric spikes $1\frac{1}{2}'$–$4'$ long, on stout peduncles $\frac{1}{2}'$–$\frac{3}{4}'$ in length; calyx glabrous or puberulous, about one fourth as long as the narrowly oblong acute petals, glabrous or puberulous on the outer surface and covered on the inner surface toward the apex with hoary tomentum; stamens twice as long as the corolla, the dark-colored connective of the anther-cells furnished at apex with a stalked gland; ovary short-stalked, clothed with silky hairs. **Fruit** in drooping clusters, linear, at first flat, becoming subterete at maturity, constricted between the 10–20 seeds, straight or falcate, contracted at the ends, $4'$–$9'$ long, $\frac{1}{4}'$–$\frac{1}{2}'$ wide; **seeds** about $\frac{1}{4}'$ long.

A low tree, with a large thick taproot descending frequently to the depth of 40°–50°,

and furnished with radiating horizontal roots spreading in all directions and forming a dense mat, a trunk 6′–8′ in diameter, divided a short distance above the ground into many irregularly arranged crooked branches forming a loose straggling head, and slender branchlets at first pale yellow-green, turning darker in their second year, furnished in the axils of the leaves of their first season with short spur-like excrescences covered with chaffy scales, and armed with stout straight terete supra-axillary persistent spines ½′–2′ long, or rarely unarmed; more often a shrub, with numerous stems only a few feet high. **Bark** of the trunk thick, dark reddish brown, divided by shallow fissures, the surface separating into short thick scales. **Wood** heavy, close-grained, rich dark brown or sometimes red, with thin clear yellow sapwood; almost indestructible in contact with the soil, and largely used for fence-posts, railway-ties, the underpinnings of buildings, and occasionally in the manufacture of furniture, the fellies of wheels, and the pavements of city streets; the best fuel of the region, and largely made into charcoal. The ripe pods supply Mexicans and Indians with a nutritious food, and are devoured by most herbivorous animals. A gum, resembling gum-arabic, exudes from the stems.

Distribution. Western Texas and eastern New Mexico, and on the island of Jamaica; eastward and westward diverging into two extreme forms. These are

Prosopis juliflora var. glandulosa Cock.

Leaves 8′–10′ long, 2-pinnate, with long slender petioles, the pinnæ 12–20-foliolate; leaflets distant, linear, mostly acute, glabrous, dark green, often 2′ long and ⅛′–¼′ wide.

Fig. 551

Flowers with a usually glabrous calyx. **Fruit** occasionally conspicuously constricted between the seeds (f. *constricta* Sarg.).

A round-topped tree, often 20° high, with a trunk a foot in diameter, and long gracefully drooping branches forming a symmetrical round-topped head.

Distribution. Eastern Texas to western Louisiana (near Shreveport, Caddo Parish), western Oklahoma and southern Kansas, and southward into northern Mexico. The common Mesquite of eastern Texas; reappearing with rather shorter and more crowded leaflets in Arizona, southern California, and Lower California.

Prosopis juliflora var. velutina Sarg.

Leaves 5′–6′ long, often fascicled, 2–4-pinnate, cinereo-pubescent, with short petioles, the pinnæ 12–22-foliolate; leaflets oblong or linear-oblong, obtuse or acute, crowded, pale green, ¼′–½′ long. **Flowers** in densely-flowered spikes 2′–3′ long; calyx villose.

A tree, often 50° high, with a trunk 2° in diameter, covered with rough dark brown bark, and heavy irregularly arranged usually crooked branches.

Distribution. Dry valleys of southern Arizona and of Sonora.

Fig. 552

2. Prosopis pubescens Benth. Screw Bean. Screw Pod Mesquite.

Leaves canescently pubescent, 2′–3′ long, with a slender petiole $\frac{1}{3}$′–$\frac{2}{3}$′ in length, and pinnæ 1$\frac{1}{2}$′–2′ long and 10–16-foliolate; stipules spinescent, deciduous; leaflets oblong or somewhat falcate, acute, sessile or short-petiolulate, often apiculate, conspicuously reticulate-veined, $\frac{1}{3}$′–$\frac{2}{3}$′ long, $\frac{1}{8}$′ wide. **Flowers** beginning to open in early spring, and produced

Fig. 553

in successive crops from the axils of minute scarious bracts, in dense or interrupted cylindric spikes 2′–3′ long; calyx obscurely 5-lobed, pubescent on the outer surface, one third to one fourth as long as the narrow acute petals coated on the inner surface near the apex with thick white tomentum, and slightly puberulous on the outer surface; ovary and young fruit hoary-tomentose. **Fruit** ripening throughout the summer and falling in the autumn, in dense racemes, sessile, twisted with from 12–20 turns into a narrow straight spiral 1′–2′ long; **seeds** $\frac{1}{16}$′ long.

A tree, 25°–30° high, with a slender trunk sometimes a foot in diameter, and terete branches canescently pubescent or glabrate when they first appear, becoming glabrous and light red-brown in their third year, and armed with stout spines $\frac{1}{3}'$–$\frac{1}{2}'$ long. **Bark** of the trunk thick, light brown tinged with red, separating in long thin persistent ribbon-like scales. **Wood** heavy, exceedingly hard, close-grained, not strong, light brown, with thin lighter colored sapwood of 6 or 7 layers of annual growth; used as fuel and occasionally for fencing. The sweet, nutritious legumes are valued as fodder.

Distribution. Sandy or gravelly bottom-lands; valley of the Rio Grande in western Texas, and through New Mexico and Arizona to southern Utah and Nevada, and to San Diego County, California, and northern Mexico; attaining its largest size in the United States in the valleys of the lower Colorado and Gila Rivers, Arizona.

6. CERCIS L.

Trees or shrubs, with scaly bark, slender unarmed branchlets prolonged by an upper axillary bud, marked by numerous minute pale lenticels, and in their first winter by small elevated horizontal leaf-scars showing the ends of two large fibro-vascular bundles, and small scaly obtuse axillary buds covered by imbricated ovate chestnut-brown scales. Leaves simple, entire, 5–7-nerved with prominent nerves, long-petiolate, deciduous; petioles slender, terete, abruptly enlarged at apex; stipules ovate, acute, small, membranaceous, caducous. Flowers appearing in early spring before or with the leaves on thin jointed pedicels, in simple fascicles or racemose clusters produced on branches of the previous or earlier years, or on the trunk, with small scale-like bracts often imbricated at the base of the inflorescence, and minute bractlets; calyx disciferous, short-turbinate, purplish, persistent, the tube oblique at base, campanulate, enlarged on the lower side, 5-toothed, the short broad teeth imbricated in the bud; corolla subpapilionaceous; petals nearly equal, rose color, oblong-ovate, rounded at apex, unguiculate, slightly auricled on one side of the base of the blade, the upper petal slightly smaller and inclosed in the bud by the wing-petals encircled by the broader slightly imbricated keel-petals; stamens 10, inserted in 2 rows on the margin of the thin disk, free, declinate, those of the inner row opposite the petals and rather shorter than the others; filaments enlarged and pilose below the middle, persistent until the fruit is grown; anthers uniform, oblong, attached on the back near the base; ovary short-stalked, inserted obliquely in the bottom of the calyx-tube; style filiform, fleshy, incurved, with a stout obtuse terminal stigma; ovules 2-ranked, attached to the inner angle of the ovary. Legume stalked, oblong or broad-linear, straight on the upper edge, curved on the lower edge, acute at the ends, compressed, tipped with the thickened remnants of the style, many-seeded, 2-valved, the valves coriaceo-membranaceous, many-veined, tardily dehiscent by the dorsal and often by the wing-margined ventral suture, dark red-purple and lustrous at maturity. Seeds suspended transversely on a slender funicle, ovoid or oblong, compressed, the small depressed hilum near the apex; seed-coat crustaceous, bright reddish brown; embryo surrounded by a thin layer of horny albumen, compressed; cotyledons oval, flat, the radicle short, straight or obliquely incurved, slightly exserted.

Cercis is confined to eastern and western North America, southern Europe, and to southwestern, central and eastern Asia. Of the eight species now distinguished, three occur in North America. Two of these are arborescent.

The generic name is from *κερκίς*, the Greek name of the European species, from a fancied resemblance of the fruit to the weaver's implement of that name.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT SPECIES.

Flowers in sessile clusters; leaves ovate, acute, cordate or truncate at base. 1. **C. canadensis** (A, C).

Flowers fascicled or slightly racemose; leaves reniform. 2. **C. reniformis** (C).

1. Cercis canadensis L. Redbud. Judas-tree.

Leaves broad-ovate, acute or acuminate and often abruptly contracted at apex into a short broad point, truncate or more or less cordate at base, entire, glabrous with the exception of axillary tufts of white hairs, or sometimes more or less pubescent below, 3′–5′ long and broad; turning in the autumn before falling bright clear yellow; petioles 2′–5′ in length. **Flowers** ½′ long, on pedicels ⅓′–½′ in length and fascicled 4–8 together; rarely white (var. *alba* Rehdr.). **Fruit** fully grown in the south by the end of May and at the north at midsummer, and then pink or rose color, 2½′–3½′ long, falling late in the autumn or in early winter; **seeds** about ¼′ long.

A tree, sometimes 40°–50° high, with a straight trunk usually separating 10°–12° from the ground into stout branches covered with smooth light brown or gray bark, and forming an upright or often a wide flat head, and slender glabrous somewhat angled branchlets, brown and lustrous during their first season, becoming dull and darker the following year and ultimately dark or grayish brown. **Bark** of the trunk about ½′ thick and divided by deep longitudinal fissures into long narrow plates, the bright red-brown surface separating into thin scales. **Wood** heavy, hard, not strong, close-grained, rich dark brown tinged with red, with thin lighter colored sapwood of 8–10 layers of annual growth.

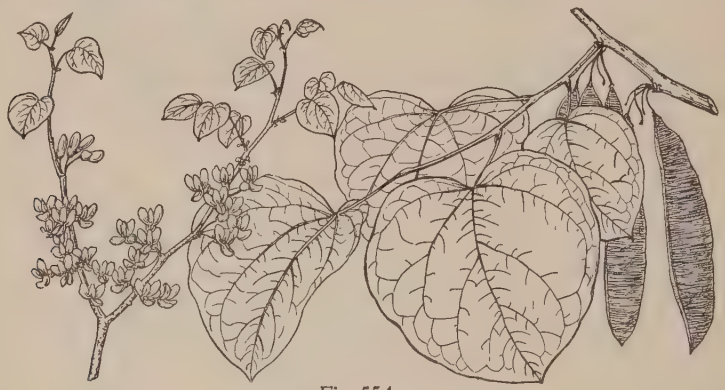

Fig. 554

Distribution. Borders of streams and rich bottom-lands, forming, especially west of the Alleghany Mountains, an abundant undergrowth to the forest; valley of the Delaware River, New Jersey, central and southern Pennsylvania southward to northern Florida, northern Alabama and southern Mississippi (Crystal Springs, Copiah County), and westward to southwestern Ontario (Point Pelee, Essex County), and through southern Michigan to southern Iowa, southeastern Nebraska, eastern Kansas, to western Oklahoma (Major and Dewey Counties), Louisiana, and the valley of the Brazos River, Texas; and on the Sierra Madre of Nuevo Leon; common and of its largest size in southwestern Arkansas, Oklahoma and eastern Texas, and in early spring a conspicuous feature of the landscape.

Often cultivated as an ornamental tree in the northeastern states, and occasionally in western Europe.

2. Cercis reniformis Engl. Redbud.

Cercis texensis Sarg.

Leaves reniform, when they unfold light green and slightly pilose, and at maturity subcoriaceous, dark green and lustrous on the upper surface, paler, glabrous or pubescent on the lower surface, and 2′–3′ in diameter; petioles 1½′–2′ in length. **Flowers** about ½′

long, on slender pedicels $\frac{1}{2}'$–$\frac{3}{4}'$ in length and fascicled in sessile clusters, or occasionally racemose. **Fruit** 2′–4′ long, $\frac{1}{2}'$–1′ wide; **seeds** $\frac{1}{4}'$ long.

A slender tree, occasionally 20° or rarely 40° high, with a trunk 6′–12′ in diameter, and glabrous branchlets marked by numerous minute white lenticels, light reddish brown during their first and second years, becoming dark brown in their third season; more often a shrub, sending up numerous stems and forming dense thickets only a few feet high.

Fig. 555

Bark of the trunk and branches thin, smooth, light gray. **Wood** heavy, hard, close-grained, brown streaked with yellow, with thin lighter colored sapwood of 5 or 6 layers of annual growth.

Distribution. Limestone hills and ridges; neighborhood of Dallas, Dallas County, Texas to the Sierra Madre of Nuevo Leon; common in the valley of the upper Colorado River, Texas; of its largest size on the mountains of northeastern Mexico.

7. GYMNOCLADUS Lam.

Trees, with stout unarmed blunt branchlets with a thick pith, prolonged by axillary buds, rough deeply fissured bark, thick fleshy roots, and minute buds depressed in pubescent cavities of the bark, 2 in the axil of each leaf, superposed, remote, the lower and smaller sterile and nearly surrounded by the enlarged base of the petiole, their scales 2, ovate, rounded at apex, coated with thick dark brown tomentum, infolded one over the other, accrescent with the young shoots. Leaves deciduous, unequally bipinnate; pinnæ many-foliolulate, with 1 or 2 pairs of the lowest pinnæ reduced to single leaflets; pinnæ and leaflets usually alternate; leaflets thin, ovate, entire, petiolulate; stipules foliaceous, early deciduous. Flowers regular, dicœcious, greenish white, long-pedicellate, the slender pedicels from the axils of long lanceolate scarious caducous bracts, bibracteolate near the middle; staminate flowers in a short terminal racemose corymb; pistillate flowers in elongated terminal racemes, on pedicels much longer than those of the staminate flowers; calyx tubular, elongated, 10-ribbed, lined with a thin glandular disk, 5-lobed, the lobes lanceolate, acute, nearly equal, erect; petals 4 or 5, oblong, rounded or acute at apex, pubescent, as long as the calyx-lobes or rather longer and twice as broad, inserted on the margin of the disk, spreading or reflexed; stamens 10, free, inserted with the petals, erect, included; filaments filiform, pilose, those opposite the petals shorter than the others; anthers oblong, uniform, small and sterile in the pistillate flower; ovary sessile or slightly stipitate, acute; styles short, erect, obliquely dilated into 2 broad lobes stigmatic on their

inner surface, rudimentary or 0 in the sterile flower; ovules numerous, suspended from the angle opposite the posterior petals. Legume oblong, subfalcate, turgid or slightly compressed, several-seeded, 2-valved, tardily dehiscent, the thin tough woody valves thickened on the margins into narrow wings, pulpy between the seeds. Seeds ovoid or slightly obovoid, suspended by a long slender funicle; seed-coat thick, bony, brown and opaque, of 3 layers; embryo surrounded by a thin layer of horny albumen; cotyledons ovate, orange-colored, thick and fleshy, the radicle short, erect.

Gymnocladus, with two species, is confined to eastern North America and to central China.

Gymnocladus is slightly astringent and purgative, and the detersive pulp surrounding the seeds of the Asiatic species is used in China as a substitute for soap.

The generic name, from γυμνός and κλάδος, relates to the stout branchlets destitute of spray.

1. Gymnocladus dioicus K. Koch. Kentucky Coffee-tree. Mahogany.

Leaves 1°–3° long, 18′–24′ wide, obovate, 5–9 pinnate, the pinnæ 6–14-foliolate, covered when they unfold with hoary tomentum except on the upper surface of the ovate acute

Fig. 556

leaflets, often mucronate, especially while young, cuneate or irregularly rounded at base, pink at first, soon becoming bronze-green and lustrous, glabrous on the upper surface with the exception of a few scattered hairs along the midrib, and at maturity thin, obscurely veined, dark green above, pale yellow-green and glabrous below, with the exception of a few short hairs scattered along the narrow midrib, 2′–2½′ long and 1′ wide, or those replacing the lowest or occasionally the 2 lower pairs of pinnæ sometimes twice as large; turning bright clear yellow in the autumn before falling; petioles abruptly and conspicuously enlarged at base, at first hoary-tomentose, becoming glabrous at maturity; stipules lanceolate or slightly obovate, glandular-serrate toward the apex, ⅓′ long. **Flowers:** inflorescence of the staminate tree 3′–4′ long, the lower branches usually 3 or 4-flowered; inflorescence of the pistillate tree 10′–12′ long, the flowers on stout pedicels 1′–2½′ long or twice to five times as long as those of the staminate flowers; flowers hoary-tomentose in the bud; calyx ⅔′ long, covered on the outer surface when the flowers open with pale hairs and on the inner surface with hoary tomentum; petals keeled, pilose on the back, slightly grooved, tomentose on the inner surface; anthers bright orange color; ovary hairy. **Fruit** 6′–10′ long, 1½′–2′ wide, dark red-brown, covered with a glaucous bloom, on stout stalks 1′–2′ in length, remaining unopened on the branches through the winter; **seeds** separated by a thick layer of dark-colored sweet pulp, ¾′ long.

A tree, 75°–110° high, with a trunk 2°–3° in diameter, usually dividing 10°–15° from the ground into 3 or 4 principal stems spreading slightly and forming a narrow round-topped head, or occasionally sending up a tall straight shaft destitute of branches for 70°–80°, and branchlets coated when they first appear with short dense pubescence faintly tinged with red, bearing at their base the conspicuous orange-green obovate pubescent bud-scales, $\frac{1}{4}'$–$\frac{1}{3}'$ thick at the end of their first season, very blunt, dark brown, often slightly pilose, marked by orange-colored lenticels, and roughened by the large pale broadly heart-shaped leaf-scars displaying the ends of 3 or 4 conspicuous fibro-vascular bundles. **Bark** of the trunk $\frac{3}{4}'$–$1'$ thick, deeply fissured, dark gray tinged with red, and roughened by small persistent scales. **Wood** heavy although not hard, strong, coarse-grained, very durable in contact with the soil, rich light brown tinged with red, with thin lighter colored sapwood of 5 or 6 layers of annual growth; occasionally used in cabinet-making and for fence-posts, rails, and in construction. The seeds were formerly used as a substitute for coffee; a decoction of the fresh green pulp of the unripe fruit is used in homœopathic practice.

Distribution. Bottom-lands in rich soil; central and western New York and Franklin County, Pennsylvania, through southern Ontario and southern Michigan to southeastern Minnesota, northeastern and southern Iowa, southeastern South Dakota, eastern and northeastern Nebraska, eastern Kansas, northern and western Arkansas and northeastern Oklahoma (with isolated stations in Woods and Custer Counties and in the western parts of Cimarron County); in eastern Kentucky, and western and middle Tennessee; nowhere common.

Occasionally cultivated in the gardens and parks of the eastern United States, and of northern and central Europe.

8. GLEDITSIA L.

Trees, with furrowed bark, slender terete slightly zigzag branchlets thickened at the apex and prolonged by axillary buds, thick fibrous roots, the trunk and branches often armed with stout simple or branched spines or abortive branchlets developed from supra-axillary or adventitious buds imbedded in the bark. Winter-buds minute, 3 or 4 together, superposed, the 2 or 3 lower without scales and covered by the scar left by the falling of the petiole, the upper larger, nearly surrounded by the base of the petiole and covered by small scurfy scales. Leaves long-petiolate, often fascicled in earlier axils, abruptly pinnate or bipinnate, the pinnæ increasing in length from the base to the apex of the leaf, the lowest sometimes reduced to single leaflets; deciduous; leaflets thin, their margins irregularly crenate, without stipels; stipules minute, caducous. Flowers regular, polygamous, minute, green or white on short pedicels, in axillary or lateral simple or fascicled racemes, with minute scale-like caducous bracts; calyx campanulate, lined with the disk, 3–5-lobed, the narrow lobes nearly equal; petals as many as the lobes of the calyx, nearly equal; stamens 6–10, inserted with the petals on the margin of the disk, exserted; filaments free, filiform, erect; anthers uniform, much smaller and abortive in the pistillate flower; ovary subsessile, rarely bicarpellary, rudimentary or 0 in the staminate flower; styles short; stigma terminal, more or less dilated, often oblique; ovules 2 or many, suspended from the angle opposite the posterior petal. Legume compressed, many-seeded, elongated, straight and indehiscent, or 1–3-seeded, ovoid and tardily dehiscent. Seeds transverse, ovoid to suborbicular, flattened, attached by a long slender funicle; seed-coat thin, crustaceous, light brown; embryo surrounded by a layer of horny orange-colored albumen; cotyledons subfoliaceous, compressed; radicle short, erect, slightly exserted.

Gleditsia is confined to eastern North America, where three species occur, southwestern Asia, China, Formosa, Japan, and west tropical Africa. It produces strong, durable, coarse-grained wood. In Japan the pods are used as a substitute for soap.

The generic name is in honor of Johann Gottlieb Gleditsch (1714–1786), professor of botany at Berlin.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT SPECIES.

Legume linear-oblong, elongated, many-seeded, indehiscent.
Legume 12′–18′ long, with pulp between the seeds; ovary hoary-tomentose.
1. **G. triacanthos** (A, C).
Legume 4′–5′ long, without pulp between the seeds. 2. **G. texana** (C).
Legume oval, oblique, 1–3-seeded, without pulp, tardily dehiscent; ovary glabrous.
3. **G. aquatica** (A, C).

1. Gleditsia triacanthos L. Honey Locust.

Leaves 7′–8′ long, 18–28-foliolulate or sometimes bipinnate, with 4–7 pairs of pinnæ, those of the upper pair 4′–5′ long, when they unfold hoary-tomentose, and at maturity pubescent on the petiole and rachis, the short stout petiolules, and the under surface of the midrib of the oblong-lanceolate leaflets, unequal at base, acute or slightly rounded

Fig. 557

at apex, remotely crenulate-serrate, dark green and lustrous above, dull yellow-green below, 1′–1½′ long and ½′ wide; turning in the autumn pale clear yellow. **Flowers** appearing in June when the leaves are nearly fully grown from the axils of leaves of previous years; the staminate in short many-flowered pubescent racemes 2′–2½′ long and often clustered; the pistillate in slender graceful few-flowered usually solitary racemes 2½′–3½′ long; calyx campanulate, narrowed at base, the acute lobes thickened, revolute and ciliate on the margins, villose with pale hairs, rather shorter than and half as wide as the erect acute petals; filaments pilose toward the base; anthers green; pistil rarely of 2 carpels, hoary-tomentose. **Fruit** 12′–18′ long, dark brown, pilose and slightly falcate, with straight thickened margins, 2 or 3 together in short racemes on stalks 1′–1½′ long, their walls thin and tough, contracting in drying by a number of corkscrew twists, and falling late in the autumn or early in winter; **seeds** oval, ⅓′ long, separated by thick succulent pulp.

A tree, 75°–140° high, with a trunk 2°–3° or occasionally 5°–6° in diameter, slender spreading somewhat pendulous branches forming a broad open rather flat-topped head, and branchlets marked by minute lenticels, at first light reddish brown and slightly puberulous, soon becoming lustrous and red tinged with green, and in their second year greenish brown and armed with stout rigid long-pointed simple or 3-forked spines at first red, and bright chestnut-brown when fully grown, or rarely unarmed (var. *inermis* Pursh.). **Bark** of the trunk ½′–¾′ thick, divided by deep fissures into long narrow longitudinal ridges and

roughened on the surface by small persistent scales. **Wood** hard, strong, coarse-grained, very durable in contact with the ground, red or bright red-brown, with thin pale sapwood of 10–12 layers of annual growth; largely used for fence-posts and rails, for the hubs of wheels, and in construction.

Distribution. Borders of streams and intervale lands, in moist fertile soil, usually growing singly or occasionally covering almost exclusively considerable areas; less commonly on dry sterile gravelly hills; western slope of the Alleghany Mountains of Pennsylvania, westward through southern Ontario and southern Michigan to southeastern Minnesota, southern Iowa, southeastern South Dakota, eastern Nebraska, eastern Kansas, and Oklahoma to the Salt Fork of the Arkansas River (near Alva, Woods County) and to creek valleys near Cache, Comanche County (*G. W. Stevens*), and southward to northern Alabama, Mississippi and middle Florida (St. Marks, Wakulla County), and to the valley of the Brazos River, eastern Texas; and in the cañon of Paloduro Creek near Canyon, Randall County, northwestern Texas (*E. J. Palmer*); in Pennsylvania and West Virginia occasionally on the eastern slopes of the Appalachian Mountains; attaining its largest size in the valleys of small streams in southern Indiana and Illinois; now often naturalized in the region east of the Alleghany Mountains. The var. *inermis*, the prevailing form in Richland County, Illinois, and in Taney County, southern Missouri.

Often cultivated as an ornamental and shade tree in all countries of temperate climates.

2. Gleditsia texana Sarg. Locust.

Gleditsia brachycarpa Nutt., not Pursh.

Leaves 6′–7′ long, 12–22-foliolulate, with a slender rachis at first puberulous, ultimately glabrous, or often bipinnate, usually with 6 or 7 pairs of pinnæ, the lower pairs frequently reduced to single large leaflets; leaflets oblong-ovate, often somewhat falcate,

Fig. 558

rounded or acute or apiculate at apex, obliquely rounded at base, finely crenately serrate, thick and firm in texture, dark green and lustrous above, pale below, ½′–1′ long, with a short petiolule coated while young, like the base of the slender orange-colored midrib, with soft pale hairs. **Flowers** appearing toward the end of April, the staminate dark orange-yellow, in slender glabrous often clustered racemes lengthening after the flowers begin to open and finally 3′–4′ in length; calyx campanulate, with acute lobes thickened on the margins, villose-pubescent and rather shorter and narrower than the puberulous petals; stamens with slender filaments villose near the base and green anthers; pistillate flowers unknown. **Fruit** 4′–5′ long, 1′ wide, straight, much compressed, rounded and short-pointed at apex, full and rounded at the broad base, thin-walled, dark chestnut-brown,

puberulous, slightly thickened on the margins, many-seeded, without pulp; seeds oval, compressed, dark chestnut-brown, very lustrous, ½′ long.

A tree, 100°–120° high, with a trunk rarely exceeding 2½° in diameter, ascending and spreading branches forming a narrow head, and comparatively slender more or less zigzag branchlets roughened by numerous small round lenticels, light orange-brown when they first appear, gray or orange-brown during their first year, ashy gray the following season, and unarmed. Bark thin and smooth.

Distribution. In a group on the bottom-lands of the Brazos River, near the town of Brazoria, Brazoria County, Texas; Louisiana, near Shreveport, Caddo Parish (*R. S. Cocks*, 1907); Mississippi, Yazoo City, Yazoo County (*S. M. Tracey*, 1911); Indiana (Knox and Gibson Counties, *J. Schneck*, Plant World, vii. 252 [1904]), Gibson County (*C. C. Deam*, 1921).

Perhaps best considered a hybrid between *G. triacanthos* and *G. aquatica*.

3. Gleditsia aquatica Marsh. Water Locust.

Leaves 5′–8′ long, 12–20-foliolate, or bipinnate, with 3 or 4 pairs of pinnæ; leaflets ovate-oblong, usually rounded or rarely emarginate at apex, unequally cuneate at base,

Fig. 559

slightly and remotely crenate or often entire below the middle, glabrous with the exception of a few hairs on the short stout petiolule, dull yellow-green and lustrous on the upper surface, dark green on the lower surface, about 1′ long and ⅓′–½′ wide. Flowers appearing in May and June after the leaves are fully grown on short stout purple puberulous pedicels, in slender racemes 3′–4′ long; calyx-tube covered with orange-brown pubescence, the lobes narrow, acute, slightly pilose on the two surfaces, as long as but narrower than the green erect petals rounded at apex; filaments hairy toward the base; anthers large, green; ovary long-stipitate, glabrous. Fruit fully grown in August, pendent in graceful racemes, obliquely ovoid, long-stalked, crowned with a short stout tip, thin, 1′–2′ long, 1′ broad, without pulp, its valves thin, tough, papery, bright chestnut-brown, lustrous and somewhat thickened on the margins; seeds 1 or rarely 2 or 3, flat, nearly orbicular, orange-brown, ½′ in diameter.

A tree, 50°–60° high, with a short trunk 2°–2½° in diameter, usually dividing a few feet from the ground into stout spreading often contorted branches forming a wide irregular flat-topped head, and glabrous orange-brown branchlets becoming in their second year gray or reddish brown, marked by occasional large pale lenticels, and armed with usually flattened simple or short-branched straight or falcate sharp rigid spines 3′–5′ long, about ½′ broad at the base, and dark red-brown and lustrous. Bark ⅛′–¼′ thick, smooth, dull gray or reddish brown, and divided by shallow fissures into small plate-like scales. Wood

heavy, very hard and strong, coarse-grained, rich bright brown tinged with red, with thick light clear yellow sapwood of about 40 layers of annual growth.

Distribution. Eastern South Carolina to Florida, through the coast region of the Gulf states except in Alabama to the valley of the Brazos River, Texas, and northward through western Louisiana and southern Arkansas to northwestern Mississippi, middle Kentucky and Tennessee, the bottoms of the Mississippi, southeastern Missouri, western and southern Illinois and southwestern Indiana; rare east of the Mississippi River and only in deep river swamps; very abundant and of its largest size westward on rich bottom-lands; in Louisiana and Arkansas often occupying extensive tracts submerged during a considerable part of the year.

9. PARKINSONIA L.

Trees or shrubs, with smooth thin bark and terete branches often armed with simple or 3-forked spines. Leaves abruptly bipinnate, alternate or fascicled from earlier axils, short-petiolate, the rachis short and spinescent, with 2–4 secondary elongated rachises bearing numerous minute opposite entire leaflets without stipels; stipules short, persistent and spinescent, or caducous. Flowers perfect on thin elongated jointed pedicels from the axils of minute caducous bracts, in slender axillary solitary or fascicled racemes; calyx short-campanulate, 5-lobed, the lobes slightly inbricated or subvalvate in the bud, narrow, membranaceous, nearly equal, becoming reflexed, deciduous; petals bright yellow, unguiculate, much longer than the lobes of the calyx, spreading, the upper petal rather broader than the others and glandular at the base of the claw; stamens 10, inserted in 2 rows on the margin of the thin disk, free, slightly declinate, those of the outer row opposite the sepals and rather longer than the others; filaments villose below the middle, the upper filament enlarged at base and gibbous on the upper side; anthers uniform, versatile; ovary short-stipitate, pilose, contracted into a slender filiform incurved style infolded in the bud and tipped with a minute stigma; ovules numerous, suspended from the inner angle of the ovary. Legume linear, torulose, acuminate at the ends, 2-valved, the valves thin, convex by the growth of the seeds, contracted between and beyond them, longitudinally striate. Seeds oblong, suspended longitudinally on a slender funicle; hilum minute, near the apex; seed-coat thin, crustaceous, light brown; embryo inclosed on the sides only by thick layers of horny albumen; cotyledons oval, flat, slightly fleshy, the radicle very short and straight.

Parkinsonia, with four species, is confined to the warm parts of America and to southern Africa. Two species occur within the limits of the United States.

The genus is named for John Parkinson (1567–1650), an English botanical author, and herbalist to James I.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Flowers in long slender racemes; petals imbricated in the bud; stamens shorter than the petals; legume 1–8-seeded, 12′–18′ long; leaves 7′–8′ long; rachis of the pinnæ flat, wing-margined, 50–60-foliolate; branches with spines. 1. **P. aculeata** (G, H).

Flowers in short racemes; petals valvate in the bud; stamens longer than the petals; legume 1–2-seeded; leaves about 1′ long; rachis of the pinnæ terete, 8–12-foliolate; branches without spines. 2. **P. microphylla** (G, H).

1. Parkinsonia aculeata L. Retama. Horse Bean.

Leaves of two forms, short-petiolate, persistent, light green and glabrous, except for a few hairs on the lower part of the young secondary rachis, 12′–18′ long; primary leaves on young branches, with 2–4 pinnæ, and a spinescent rachis developing into a stout ridged persistent short-pointed chestnut-brown spine 1′–1½′ long and marked near the base by the prominent scars left by the fall of the pinnæ; stipules persistent, appearing as lateral spiny branches on the spines; secondary leaves fascicled from the axils of the primary leaves, nearly sessile with a short terete spinescent rachis and 2 pinnæ; pinnæ flat, 12′–18′ in length, wing-margined, acute at apex, with 25–30 pairs of ovate or obovate petiolulate

leaflets, $\frac{1}{16}'$–$\frac{1}{8}'$ long. **Flowers** appearing on the growing branches during the spring and summer, and in the tropics throughout the year, on slender pedicels $\frac{1}{3}'$–$\frac{1}{2}'$ in length, in slender erect racemes 5′–6′ long; petals bright yellow, the upper one marked near the base on the inner surface with conspicuous red spots; stamens shorter than the petals. **Fruit** hanging on pedicels $\frac{1}{2}'$–$\frac{3}{4}'$ in length, in graceful racemes, 2′–4′ long, long-pointed, dark orange-brown, slightly pilose, compressed between the remote seeds; **seeds** $\frac{1}{3}'$ long, nearly terete, with thick albumen and a bright yellow embryo.

A tree, 18°–30° high, with a trunk sometimes a foot in diameter, usually separating 6°–8° from the ground into slender spreading somewhat pendulous branches forming a wide graceful head, and slightly zigzag branchlets puberulous and yellow-green during their first season, becoming glabrous, gray or light orange color and roughened by lenticels in their second and third years. **Bark** of the trunk about $\frac{1}{8}'$ thick, brown tinged with red, the generally smooth surface broken into small persistent plate-like scales. **Wood**

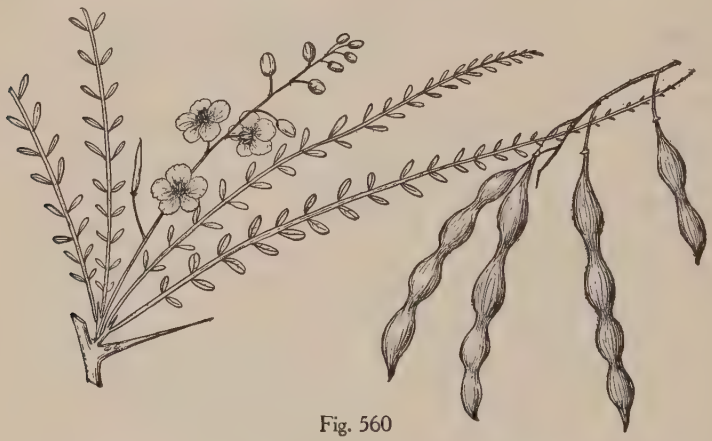

Fig. 560

heavy, hard, close-grained, with very thick lighter colored sapwood tinged with yellow.

Distribution. Low moist soil, valley of the lower Rio Grande, Texas; common in northern Mexico and in the valley of the lower Colorado River, Arizona; widely distributed in Lower California; naturalized on Key West, the Bahamas, the West Indian islands, and in many other tropical countries.

Cultivated in most warm countries as an ornament of gardens, and to form hedges.

2. Parkinsonia microphylla Torr.

Leaves 1′ long, pale, densely tomentose when they unfold, pubescent at maturity, deciduous at the end of a few weeks; petiole $\frac{1}{4}'$ long; rachis short, rarely spinescent; leaflets in 4–6 pairs, distant, entire, sessile, broad-oblong or nearly orbicular, obtuse or somewhat acute at apex, oblique at base, $\frac{1}{8}'$ long; stipules caducous. **Flowers** opening in May or early June before the leaves, on slender pedicels, in racemes 1′ or less long from the axils of leaves of the previous year, pale yellow; stamens longer than the petals. **Fruit** persistent on the branches for at least a year, frequently 1 or 2, rarely 3-seeded, 2′–3′ long, slightly puberulous, especially toward the base, with a long acuminate often falcate apex; **seeds** compressed, $\frac{1}{3}'$ long, with a bright green embryo.

An intricately branched tree, occasionally 20°–25° high, with a trunk a foot in diameter, and stout pale yellow-green rigid branchlets terminating in a stout spine, covered at first with deciduous tomentum, slightly puberulous during their first and second seasons, and often marked by the persistent scales of undeveloped buds. **Bark** dark orange color, gen-

erally smooth, although sometimes roughened by scattered clusters of short pale gray horizontal ridges, becoming on old trees $\frac{1}{4}'$ thick; more often a shrub, frequently only a few feet tall. **Wood** heavy, hard, close-grained, dark orange-brown streaked with red, with thick light brown or yellow sapwood of 25–30 layers of annual growth.

Fig. 561

Distribution. Deserts of southern Arizona and adjacent regions of California and Sonora, and in northern Lower California; known to attain the size and habits of a tree only in the neighborhood of Wickenburg, Maricopa County, Arizona.

10. CERCIDIUM Tul.

Trees or shrubs, with stout tortuous branches, covered with bright green bark and armed with slender straight axillary spines, and minute obtuse buds. Leaves alternate, abruptly pinnate, petiolate, early deciduous; pinnæ 2 or occasionally 3, 6–8-foliolate; stipules inconspicuous or 0; leaflets ovate or obovate, without stipels. Flowers perfect in short few-flowered axillary racemes, solitary or fascicled, with minute membranaceous early deciduous bracts; calyx 5-lobed, the lobes equal, acute, reflexed at maturity, their margins scarious, slightly revolute; petals orbicular or short-oblong, unguiculate, bright yellow, the upper petal broader and longer clawed than the others, slightly auriculate at base of the blade, the claw conspicuously glandular at base; stamens 10, inserted with the petals on the margin of the disk, free, slightly declinate, exserted; filaments filiform, pilose below, the upper filament enlarged at base and gibbous on the upper side; anthers uniform, ovoid, versatile; ovary short-stalked, inserted at the base of the calyx-tube; styles slender, involute, infolded in the bud, with a minute terminal stigma; ovules suspended from the angle of the ovary opposite the posterior petal. Legume linear-oblong, compressed or somewhat turgid, straight or slightly contracted between the seeds, thickened on the margins, the ventral suture acute, or slightly grooved, tipped with the remnants of the style, tardily dehiscent, 2-valved, the valves membranaceous or subcoriaceous, obliquely veined. Seeds suspended longitudinally on a long slender funicle, ovoid, compressed, the minute hilum near the apex; seed-coat thin, crustaceous; embryo compressed, light green, covered on the sides only by a thin layer of horny albumen; cotyledons oval, flat, rather fleshy; radicle very short, erect, near the hilum.

Cercidium is confined to the warmer parts of the New World, where it is distributed with four or five species from the southern borders of the United States through Mexico, Central America, and Venezuela to Mendoza. Of the three species found within the territory of the United States two are small trees.

Cercidium produces hard wood sometimes used as fuel.

The generic name, from κερκίδιον, refers to the fancied resemblance of the legume to the weaver's instrument of that name.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT SPECIES.

Legume compressed, with straight margins; leaflets green, slightly glandular.
1. **C. floridum** (E).

Legume somewhat turgid, the margins often slightly contracted between the seeds; leaflets glaucous.
2. **C. Torreyanum** (G, H).

1. Cercidium floridum Benth. Green-barked Acacia.

Leaves 1′–1½′ long, with 2 or rarely 3 pinnæ, a broad pubescent petiole and rachis, and oval or somewhat obovate dull green puberulous minutely glandular leaflets about ⅛′ in length, rounded or slightly emarginate at apex, and when they unfold covered on the lower surface with scattered white hairs; petiolules short, stout, pubescent; appearing in April and deciduous in October. **Flowers** opening with the leaves, and produced in succ-

Fig. 562

essive crops during three or four months, ¾′ in diameter, on slender pedicels, in 4 or 5-flowered racemes 1½′–2′ long, with small acute minute membranaceous caducous bracts. **Fruit** compressed, oblong, straight or slightly falcate, acute, narrowly and acutely margined on the ventral suture, glabrous, 2 or 3-seeded, 2′–2½′ long, ½′ broad, tardily dehiscent, the valves papery, yellow tinged with brown on the outer surface, and bright orange color within; **seeds** ½′ long.

A tree, 18°–20° high, with a short crooked trunk 8′–10′ in diameter, stout spreading branches covered with thin smooth bright green bark, forming a low wide head, and branchlets light or dark olive-green, slightly puberulous at first, soon glabrous, marked by occasional black lenticels, and armed with slender spines 1′ or less in length. **Bark** ⅛′ thick, light brown tinged with red, with numerous short horizontal light gray ridge-like excrescences. **Wood** light, soft, close-grained, pale yellow tinged with green, with thick lighter colored sapwood.

Distribution. Shores of Matagorda Bay to Hidalgo and Valverde Counties, Texas, and in northern Mexico; not common in Texas; very abundant and a conspicuous feature of vegetation in Mexico from the mouth of the Rio Grande to the foothills of the Sierra Madre.

2. Cercidium Torreyanum Sarg. Green-barked Acacia. Palo Verde.

Leaves few and scattered, 1′ long, hoary-tomentose when they first appear, puberulous at maturity, with a slender petiole and 2 pinnæ, with 2 or 3 pairs of oblong obtuse glaucous leaflets narrowed toward the somewhat oblique base, $\frac{1}{12}$′–$\frac{1}{6}$′ long; unfolding in March and April and falling almost immediately when fully grown. **Flowers** $\frac{3}{4}$′ in diameter, on slender pedicels $\frac{3}{4}$′–1′ long, in 4 or 5-flowered racemes about 1′ in length, with small acute membranaceous caducous bracts. **Fruit** ripening and falling in July, 3′–4′ long, $\frac{1}{4}$′–$\frac{1}{3}$′ wide, 2–8-seeded, slightly turgid, often somewhat contracted between the seeds, frequently grooved on the ventral suture; **seeds** turgid, $\frac{1}{3}$′ long.

A low intricately branched tree, leafless for most of the year, 25°–30° high, with a short often inclining trunk 18′–20′ in diameter, stout spreading branches covered with yellow

Fig. 563

or olive-green bark, forming a wide open irregular head, and glabrous slightly zigzag light yellow or pale olive-green and glaucous branchlets armed with thin straight or curved spines $\frac{1}{4}$′ long. **Bark** thin, smooth, pale olive-green, becoming near the base of old trunks reddish brown, $\frac{1}{8}$′ thick, furrowed and separating into thick plate-like scales. **Wood** heavy, not strong, soft, close-grained, light brown, with clear light yellow sapwood.

Distribution. Sides of low cañons and depressions, and sandhills of the desert; valley of the lower Gila River, Arizona, to the Colorado Desert of southern California, and southward into Sonora and Lower California; when in flower in early spring the conspicuous and most beautiful feature of the vegetation of the Colorado Desert.

11. SOPHORA L.

Trees or shrubs, with minute scaly buds, unarmed terete branches prolonged by an upper axillary bud, and fibrous roots. Leaves unequally pinnate, with numerous small or few and ample thin or coriaceous leaflets; stipules minute, deciduous; stipels often 0. Flowers in terminal or axillary racemes, with linear minute deciduous bracts and bractlets; calyx broad-campanulate, often slightly turbinate or obconic at base, obliquely truncate, the short teeth nearly equal or the 2 upper subconnate and often somewhat larger than the others; disk cupuliform, glandular, adnate to the calyx-tube; corolla papilionaceous; petals white or violet blue, unguiculate; standard obovate or orbicular, usually shorter than the oblong, suberect keel-petals, as long or rather longer than the oblong-oblique wings, overlapping each other at the back, barely united; stamens free, or 9 of them slightly united at base, uniform; anthers attached on the back near the middle; ovary short-stipitate, contracted into an incurved style, with a minute truncate or slightly

rounded capitate stigma; ovules numerous, suspended from the inner angle of the ovary, superposed, amphitropous. Legume terete, much contracted between the seeds, woody or fleshy, usually many-seeded, each seed inclosed in a separate cell, indehiscent. Seed oblong or oval, sometimes somewhat compressed; seed-coat thick, membranaceous or crustaceous; cotyledons thick and fleshy; radicle short and straight or more or less elongated and incurved.

Sophora is scattered over the warmer parts of the two hemispheres, with about twenty species of trees, shrubs or herbs; of the six North American species two are small trees. Several of the species produce valuable wood, and from the pods and flower-buds of the Chinese *Sophora japonica* L., a dye is obtained used to dye white cloth yellow and blue cloth green. This tree is often cultivated as an ornament of parks and gardens in northern China, Japan, the eastern United States, and in western, central, and southern Europe.

The generic name is from *Sophera*, the Arabic name of some tree with pea-shaped flowers.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT SPECIES.

Flowers violet blue, in terminal racemes; the upper calyx-lobes larger than the others and united; legume woody; seeds without albumen; leaves coriaceous, persistent.
1. **S. secundiflora** (C, E, H).

Flowers white, in axillary racemes; calyx-lobes equal; legume fleshy; seeds with albumen; leaves thin, deciduous.
2. **S. affinis** (C).

1. Sophora secundiflora DC. Frijolito. Coral Bean.

Leaves persistent, covered when they unfold, especially on the lower surface of the leaflets, with silky white hairs, and at maturity 4′–6′ long, with a stout puberulous petiole slightly enlarged at base, and 7–9 oblong-elliptic leaflets rounded, emarginate or sometimes

Fig. 564

mucronate at apex, gradually contracted at base into a short thick petiolule, coriaceous, lustrous and dark yellow-green above, rather paler below, glabrous or sometimes slightly puberulous along the under side of the stout midrib, entire, with thickened margins, conspicuously reticulate-veined, 1′–2½′ long, ½′–1½′ wide, without stipels. **Flowers** with a powerful and delicious fragrance, appearing with the young leaves in very early spring, 1′ long, on stout pedicels sometimes 1′ in length, from the axils of subulate deciduous bracts ½′ or more long, and bibracteolate with 2 acute bractlets, in terminal 1-sided canescent racemes 2′–3′ in length; calyx campanulate, slightly enlarged on the upper side, the 3 lower teeth triangular and nearly equal, the 2 upper rather larger and united almost

throughout; petals shortly unguiculate, violet blue or rarely white, the broad erect standard marked on the inner surface near the base with a few darker spots; ovary coated with long silky white hairs. **Fruit** terete, 1′–7′ long, ½′ thick, stalked, crowned with the thickened remnants of the style, covered with thick hoary tomentum, indehiscent, 1–8-seeded, with hard woody walls ¼′ thick; **seeds** short-oblong, rounded, ½′ long, bright scarlet, with a small pale hilum and a bony seed-coat; albumen 0; cotyledons thick, orange-colored, filling the cavity of the seed; radicle short and straight.

A tree, 25°–35° high, with a straight trunk 6′–8′ in diameter, separating several feet from the ground into a number of upright branches forming a narrow head, and branchlets coated when they first appear with fine hairy tomentum, becoming glabrous or nearly glabrous in their second year and pale orange-brown; more often a shrub, with low clustered stems. **Wood** very heavy, hard, close-grained, orange-colored, streaked with red, with thick bright yellow sapwood of 10–12 layers of annual growth. The seeds contain a poisonous alkaloid, sophorin, with strong narcotic properties.

Distribution. Borders of streams, forming thickets or small groves, in low rather moist limestone soil; shores of Matagorda Bay, Texas, to the mountain cañons of New Mexico, and to those of Nuevo Leon and San Luis Potosí; of its largest size in the neighborhood of Matagorda Bay; south and west, especially west of the Pecos River, rarely more than a shrub.

Occasionally cultivated in the gardens of the southern states.

2. Sophora affinis T. & G.

Leaves deciduous, coated when they unfold with hoary pubescence, 6′–9′ long, with a slender puberulous petiole, and 13–19 elliptic, acute or obtuse slightly mucronate leaflets contracted into short stout pubescent petiolules, entire or with slightly wavy thickened

Fig. 565

margins, thin, pale yellow-green and glabrous above, paler and covered with scattered hairs or nearly glabrous below, 1′–1½′ long and ½′ wide, with a prominent orange-colored midrib, slender primary veins, and conspicuous reticulate veinlets. **Flowers** ½′ long, appearing in early spring with the young leaves, on slender canescent pedicels nearly ½′ long, from the axils of minute deciduous bracts, in slender pubescent semipendent racemes, 3′–5′ long, from the axils of the leaves at the end of the branches; calyx short-campanulate, abruptly narrowed at base, somewhat enlarged on the upper side, slightly pubescent, especially on the margins of the short nearly triangular teeth; petals short-unguiculate, white tinged with rose color; standard nearly orbicular, slightly emarginate, reflexed, as long and twice as broad as the ovate auriculate wing-petals and the keel-petals; ovary con-

spicuously stipitate, villose. **Fruit** ½′–3′ long, indehiscent, black, more or less pubescent, crowned with the thickened remnants of the style, 4–8-seeded, or rarely 1-seeded and then subglobose, with thin fleshy rather sweet walls; persistent on the branches during the winter; **seeds** oval, slightly compressed, with a thin crustaceous bright chestnut-brown seed-coat; cotyledons surrounded by a thin layer of horny albumen, bright green; radicle long and incurved.

A tree, 18°–20° high, with a trunk 8′–10′ in diameter, dividing into a number of stout spreading branches forming a handsome round-topped head, and slender terete slightly zigzag branchlets, orange-brown or dark brown and slightly puberulous when they first appear, becoming bright green marked by narrow brown ridges, and in their second year by the elevated tomentose leaf-scars. **Winter-buds** depressed, almost surrounded by the base of the petiole, with broad scales coated on the outer surface with dark brown tomentum and on the inner surface with thicker pale tomentum, and persistent on the base of the growing shoot. **Bark** of the trunk about ⅛′ thick, dark reddish brown, and broken into numerous oblong scales, the surface exfoliating in thin layers. **Wood** heavy, very hard and strong, light red in color, with thick bright clear yellow sapwood of 10–12 layers of annual growth.

Distribution. Usually on limestone hills, or on the borders of streams, ravines, or depressions in the prairie, often forming small groves; valley of the Red River at Shreveport, Caddo Parish, Louisiana, to southwestern Arkansas, and to southern Oklahoma (Choctaw and Love Counties), and southward in Texas to the valley of the San Antonio and upper Guadalupe Rivers (Kerrville, Kerr County).

12. CLADRASTIS Raf.

A tree, with copious watery juice, smooth gray bark, slender slightly zigzag terete branchlets without a terminal bud, fibrous roots, and naked axillary buds 4 together, superposed, flattened by mutual pressure into an acuminate cone, and inclosed collectively in the hollow base of the petiole, the largest and upper one only developing, the lowest minute and rudimentary. Leaves unequally pinnate, petiolate, with a stout terete petiole abruptly enlarged at base, 7–11-foliolate, deciduous; leaflets usually alternate, broadly oval, the terminal one rhombic-ovate, contracted at apex into a short broad point, cuneate at base, entire, petiolulate, without stipels, covered at first like the young shoots with fine silvery pubescence, and on the midrib with lustrous brown tomentum, at maturity thin, glabrous, dark yellow-green on the upper surface, pale on the lower surface, the midrib and numerous primary veins conspicuous, light yellow below; stipules 0. Flowers on slender puberulous pedicels, bibracteolate near the middle, with scarious caducous bractlets, in long gracefully nodding stalked terminal panicles, the lower branches racemose, and often springing from the axils of 1-flowered pedicels, the main axis slightly zigzag, and, like the branches, covered at first with a glaucous bloom and slightly pilose; bracts lanceolate, scarious, pale, caducous; calyx cylindric-campanulate, enlarged on the upper side, and obliquely obconic at base, puberulous, 5-toothed, the teeth imbricated in the bud, nearly equal, short and obtuse, the 2 upper slightly united; disk cupuliform, adnate to the interior of the calyx-tube; corolla papilionaceous; petals white, unguiculate; standard nearly orbicular, entire or slightly emarginate, reflexed above the middle, barely longer than the straight oblong wing-petals, slightly biauriculate at the base of the blade, marked on the inner surface with a pale yellow blotch; keel-petals free, oblong, nearly straight, obtuse, slightly subcordate or biauriculate at base; stamens 10, free; filaments filiform, slightly incurved near the apex, glabrous; anthers versatile; ovary linear, stipitate, bright red, villose with long pale hairs, contracted into a long slender glabrous slightly incurved subulate style; stigma terminal, minute; ovules numerous, suspended from the inner angle of the ovary, superposed. Legume glabrous, short-stalked, linear-compressed, the upper margin slightly thickened, tipped with the remnants of the persistent style, 4–6-seeded, ultimately dehiscent, the valves thin and membranaceous. Seeds

short-oblong, compressed, attached by a slender funicle; without albumen; seed-coat thin, membranaceous, dark brown; embryo filling the cavity of the seed; cotyledons fleshy, oblong, flat; radicle short, inflexed.

Four species are now known. One inhabits the southern United States, two occur in western China and one in Japan.

Cladrastis, from κλάδος and θραυστός, relates to the brittleness of the branches.

1. Cladrastis lutea K. Koch. Yellow Wood. Virgilia.

Leaves 8′–12′ in length, with leaflets 3′–4′ long and 1½′–2′ wide, the terminal leaflet rather shorter than the others and 3′–3½′ wide; turning bright clear yellow rather late in the autumn some time before falling. **Flowers** appearing about the middle of June, slightly fragrant, in panicles 12′–14′ long and 5′–6′ wide. **Fruit** fully grown by the middle of August, ripening in September and soon falling.

Fig. 566

A tree, sometimes 50°–60° high, with a trunk 1½°–2° or exceptionally 4° in diameter, usually divided 6°–7° from the ground into 2 or 3 stems, slender wide-spreading more or less pendulous brittle branches forming a wide graceful head, and zigzag branchlets clothed with pubescence when they first appear, soon becoming glabrous, during their first season light brown tinged more or less with green, very smooth and lustrous, and covered by numerous darker colored lenticels, bright red-brown in their first winter and marked by large elevated leaf-scars surrounding the buds, and dark dull brown the following year. **Bark** of the trunk ⅛′–¼′ thick, with a silvery gray or light brown surface and rather darker colored than that of the branches. **Wood** heavy, very hard, strong and close-grained, with a smooth satiny surface, bright clear yellow changing to light brown on exposure, with thin nearly white sapwood; used for fuel, occasionally for gun-stocks, and yielding a clear yellow dye.

Distribution. Limestone cliffs and ridges generally in rich soil, and often overhanging the banks of mountain streams; Cherokee County, North Carolina, and the western slopes of the high mountains of eastern Tennessee; central Tennessee and Kentucky; near Florence, Lauderdale County, and cliffs of the Warrior River, Tuscaloosa County, Alabama; Forsyth, Taney County, Galena, Stone County, and Eagle Rock, Barry County, Missouri, to northern and central Arkansas; rare and local; most abundant in the neighborhood of Nashville, Tennessee, and in Missouri.

Often planted in the eastern United States as an ornamental tree, and hardy as far north as New England; and rarely in western and southern Europe; usually only flowering in alternate years.

13. EYSENHARDTIA H. B. K.

Small glandular-punctate trees or shrubs, with slender terete branchlets. Leaves alternate, equally pinnate, petiolate; leaflets oblong, mucronate or emarginate at apex, short-petiolulate, numerous, stipellate; stipules subulate, caducous. Flowers short-pedicellate, in long spicate racemes, terminal or axillary, with subulate caducous bracts; calyx-tube campanulate, conspicuously glandular-punctate, 5-toothed, the acute teeth nearly equal, persistent; disk cupuliform, adnate to the base of the calyx-tube; corolla subpapilionaceous; petals erect, free, nearly equal, oblong-spatulate, rounded at apex, unguiculate, creamy white; standard concave, slightly broader than the wing and keel-petals; stamens 10, inserted with the petals, the superior stamen free, shorter than the others united to above the middle into a tube; anthers uniform, oblong; ovary subsessile, contracted into a long slender uncinate style geniculate and conspicuously glandular below the apex; stigma introrse, oblique; ovules 2 or 3, rarely 4, attached to the inner angle of the ovary, superposed. Legume small, oblong or linear-falcate, compressed, tipped with the remnants of the style, indehiscent, pendent. Seeds usually solitary, rarely 2, oblong-reniform, without albumen; seed-coat coriaceous; embryo filling the cavity of the seed; cotyledons flat, fleshy; radicle superior, short and erect.

Eysenhardtia is confined to the warmer parts of the New World, and is distributed from western Texas and southern New Mexico and Arizona to southern Mexico, Lower California, and Guatemala. Four species are distinguished; of these three species occur within the territory of the United States, and in northern Mexico, and one species is found only in Guatemala. Lignum nephriticum formerly celebrated in Europe for its reputed medical properties and for the fluorescence of its infusion in spring water is the wood of the shrubby *Eysenhardtia polystachya* Sarg. of western Texas and Mexico.

Of the North American species one is a small tree.

The generic name is in honor of Karl Wilhelm Eysenhardt (1794–1825), Professor of Botany in the University of Königsberg.

1. Eysenhardtia orthocarpa S. Wats.

Leaves 4′–5′ long, with a pubescent rachis grooved on the upper side, 10–23 pairs of leaflets, and small scarious deciduous stipules; leaflets oval, rounded or slightly emarginate at apex, with a stout petiolule and minute scarious deciduous stipels, pale gray-green,

Fig. 567

glabrous or slightly puberulous on the upper surface, conspicuously glandular, with chestnut-brown glands, and pubescent especially on the prominent midrib on the lower surface,

reticulate-veined, $\frac{1}{2}'$–$\frac{2}{3}'$ long, $\frac{1}{8}'$–$\frac{1}{4}'$ wide, with thickened slightly revolute margins. **Flowers** opening in May, nearly $\frac{1}{2}'$ long, on slender pubescent pedicels, in axillary pubescent spikes 3′–4′ long; calyx many-ribbed, pubescent, conspicuously glandular, half as long as the white petals ciliate on the margins, and of nearly equal size and shape. **Fruit** $\frac{1}{2}'$ long, pendent, nearly straight or slightly falcate, thickened on the edges, with usually a single seed near the apex; **seed** compressed, light reddish brown, $\frac{1}{4}'$ long.

A tree, occasionally 18°–20° high, with a trunk 6′–8′ in diameter, separating 3° or 4° above the ground into a number of slender branches, and branchlets coated when they first appear with ashy gray pubescence disappearing during the second year, and then reddish brown and roughened by numerous glandular excrescences; or more often a low rigid shrub. **Bark** of the trunk about $\frac{1}{16}'$ thick, light gray, and broken into large plate-like scales, exfoliating on the surface into thin layers. **Wood** heavy, hard, close-grained, light reddish brown, with thin clear yellow sapwood of 7 or 8 layers of annual growth.

Distribution. Dry gravelly soil, on arid slopes and dry ridges; valley of the upper Guadalupe River, western Texas, to the Santa Catalina and Santa Rita Mountains, southern Arizona, and southward into northern Mexico; arborescent in the United States only near the summit of the Santa Catalina Mountains.

14. DALEA L.

Glandular-punctate herbs, small shrubs, or rarely trees. Leaves alternate, unequally pinnate, or simple in the arborescent species; stipules generally minute, subulate, deciduous. Flowers in racemes, their bracts membranaceous or setaceous, broad, concave above, glandular-dentate; calyx 5-toothed or lobed, persistent, the divisions nearly equal; corolla papilionaceous; petals unguiculate; standard cordate, free, inserted in the bottom of the tubular disk connate to the calyx-tube, rather shorter than the wing- and keel-petals, the claws adnate to and jointed upon the staminal tube; stamens 10, sometimes 9 through the suppression of the superior stamen, united into a tube cleft above and cup-shaped toward the base; anthers uniform, often surmounted by a gland; ovary sessile or short-stalked, contracted into a slender subulate style, with a minute terminal stigma; ovules 4–6 attached to the inner angle of the ovary, superposed. Legume ovoid, sometimes conspicuously ribbed, more or less inclosed in the calyx, membranaceous, indehiscent, 1-seeded; seed reniform, without albumen; testa coriaceous; embryo filling the cavity of the seed; cotyledons broad and flat; radicle superior, accumbently reflexed.

Dalea is confined to the New World, where it is distributed from the central, western, and southwestern regions of the United States through Mexico and Central America to Peru, Chili, and the Galapagos Islands; usually herbs or low undershrubs, one species of the United States occasionally assumes the habit and attains the size of a small tree.

The generic name is in honor of Samuel Dale (1659–1739), an English botanist and writer on the materia medica.

1. Dalea spinosa A. Gray. Smoke Tree.

Leaves few, simple, irregularly scattered near the base of the spinose branchlets, cuneate or linear-oblong, sessile or nearly sessile, marked by few large glands, especially on the entire wavy margins, hoary-pubescent, $\frac{3}{4}'$–$1'$ long, $\frac{1}{8}'$–$\frac{1}{2}'$ wide, with a broad midrib and three pairs of lateral ribs, on vigorous young shoots or seedling plants remotely and coarsely serrate; remaining only for a few weeks on the branches; stipules minute, ovate, acute, pubescent. **Flowers** $\frac{1}{2}'$ long, appearing in June on short pedicels from the axils of minute bracts, in racemes $1'$–$1\frac{1}{2}'$ long, their rachis slender, spinescent, hoary-pubescent; calyx-tube 10-ribbed, with usually 5 glands between the dorsal ribs, the lobes short, ovate, rounded or more or less ciliate on the margins, reflexed at maturity; petals dark violet blue, standard cordate, reflexed, furnished at base of the blade with two conspicuous glands, wing- and keel-petals attached to the staminal tube by their base only and nearly equal in size, rounded at apex, more or less irregularly lobed at base; ovary pubescent, gland-

ular punctate. **Fruit** ovoid, pubescent, glandular, twice as long as the calyx, tipped with the remnants of the recurved style; **seed** $\frac{1}{8}'$ long, pale brown irregularly marked with dark spots.

A tree, 18°–20° high, with a short stout contorted trunk sometimes 20′ in diameter and divided near the ground into several upright branches, and branchlets reduced to slender sharp spines coated with fine pubescence, bearing minute nearly triangular scarious caducous bracts, marked by occasional glandular fistules, and developed from stouter branches hoary-pubescent when young, becoming glabrous in their third year and covered with

Fig. 568

pale brown bark roughened with lenticels and as it exfoliates showing the pale green inner bark; more often a low rigid intricately branched shrub. **Bark** of the trunk dark gray-brown, nearly $\frac{1}{4}'$ thick, deeply furrowed, and roughened on the surface by small persistent scales. **Wood** light, soft, rather close-grained, walnut-brown in color, with nearly white sapwood of 12–15 layers of annual growth.

Distribution. Valley of the lower Gila River, Arizona, through the Colorado Desert to San Felipe and Palm Springs, Riverside County, California, and southward into Sonora and Lower California.

15. ROBINIA L. Locust.

Trees or shrubs, with slender terete or slightly many-angled zigzag branchlets, without a terminal bud, minute naked subpetiolar depressed-globose axillary buds 3 or 4 together, superposed, protected collectively in a depression by a scale-like covering lined on the inner surface with a thick coat of tomentum and opening in early spring, its divisions persistent during the season on the base of the branchlet developed usually from the upper bud. **Leaves** unequally pinnate, petiolate, deciduous; leaflets entire, penniveined, stipellate, reticulate-venulose, petiolulate; stipules setaceous, becoming spinescent at maturity, persistent. Flowers on long pedicels, in short pendulous racemes from the axils of leaves of the year, with small acuminate caducous bracts and bractlets; calyx campanulate, 5-toothed or cut, the upper lobes shorter than the others, cohering for part of their length; corolla papilionaceous, petals shortly unguiculate, inserted on a tubular disk glandular on the inner surface and connate with the base of the calyx-tube; standard large, reflexed, barely longer than the wing- and keel-petals, naked on the inner surface, obcordate, reflexed; wings oblong-falcate, free; keel-petals incurved, obtuse, united below; stamens 10, inserted with the petals, the 9 inferior united into a tube often enlarged at base and cleft on the upper side, the superior stamen free at the base and connate in the middle

with the staminal tube, or finally free; anthers ovoid; ovary inserted at the base of the calyx, linear-oblong, stipitate; style subulate, inflexed, bearded along the inner side near the apex, with a small terminal stigma; ovules numerous, suspended from the inner angle of the ovary, in two ranks, superposed. Legumes in drooping many-fruited racemes, many-seeded, linear, compressed, almost sessile, 2-valved, the seed-bearing suture narrow-winged; valves thin and membranaceous. Seed oblong-oblique, transverse, attached by a stout persistent incurved funicle enlarged at the point of attachment to the placenta; seed-coat thin, crustaceous; albumen thin, membranaceous; cotyledons oval, fleshy; radicle short, much reflexed, accumbent.

Robinia with seven or eight species is confined to the United States and Mexico; of the species found in the United States three are arborescent.

The generic name commemorates the botanical labors of Jean and Vespasien Robin, arborists and herbalists of the kings of France in the sixteenth and seventeenth centuries.

CONSPECTUS OF THE ARBORESCENT SPECIES OF THE UNITED STATES.

Legume without glandular hairs; flowers white. 1. **R. Pseudoacacia** (A, C).
Legume glandular-hispid (in the arborescent form of No. 2); flowers rose color.
Glands not viscid. 2. **R. neo-Mexicana** (F, H).
Glands exuding a clammy sticky substance. 3. **R. viscosa** (A).

1. Robinia Pseudoacacia L. Locust. Acacia. Yellow Locust.

Leaves 8′–14′ long, with a slender puberulous petiole, and 7–19 leaflets; turning pale clear yellow late in the autumn just before falling; stipules $\frac{1}{2}$′ long, linear, subulate, mem-

Fig. 569

branaceous, at first pubescent and tipped with small tufts of caducous brown hairs, becoming straight or slightly recurved spines persistent for many years and ultimately often more than 1′ in length; leaflets oval, rounded or slightly truncate and minutely apiculate at apex, when they unfold covered with caducous silvery pubescence, at maturity very thin, dull dark blue-green above, pale below, glabrous with the exception of the slight pubescence on the under side of the slender midrib, $1\frac{1}{2}$′–2′ long and $\frac{1}{2}$′–$\frac{3}{4}$′ wide; petiolules stout, $\frac{1}{8}$′–$\frac{1}{4}$′ in length; stipules minute, linear, membranaceous, early deciduous. **Flowers** opening in May or early in June, filled with nectar, very fragrant, on slender pedicels $\frac{1}{2}$′ long and dark red or red tinged with green, in loose puberulous racemes 4′–5′ long; calyx conspicuously gibbous on the upper side, ciliate on the margins, dark green blotched with red, especially on the upper side, the lower lobe acuminate and much longer than the nearly trian-

gular lateral and upper lobes; petals pure white, with a large pale yellow blotch marking the inner surface of the standard. **Fruit** ripening late in the autumn, 3′–4′ long and ½′ wide, with bright red-brown valves, usually 4–8-seeded, mostly persistent until the end of winter or early spring; **seeds** $\frac{3}{16}$′ long, dark orange-brown, with irregular darker markings.

A tree, 70°–80° high, with a trunk 3°–4° in diameter, small brittle usually erect branches forming a narrow oblong head, and slender terete or sometimes slightly many-angled branchlets marked by small pale scattered lenticels, coated at first with short appressed silvery white deciduous pubescence, pale green and puberulous during their first summer, becoming light reddish brown and glabrous or nearly glabrous toward autumn. **Bark** of the trunk 1′–1½′ thick, deeply furrowed, dark brown tinged with red, and covered by small square persistent scales. **Wood** heavy, exceedingly hard and strong, close-grained, very durable in contact with the ground, brown or rarely light green, with pale yellow sapwood of 2 or 3 layers of annual growth; formerly extensively used in shipbuilding, for all sorts of posts, in construction and turnery; preferred for treenails, and valued as fuel.

Distribution. Slopes of the Appalachian Mountains, central and southern Pennsylvania, to northern Georgia; in southern Illinois, and westward to the Ozark region of southern Missouri, Arkansas and Oklahoma; now widely naturalized in the United States east of the Rocky Mountains, and nowhere common; in the Appalachian forest growing singly or in small groups up to altitudes of 3500°; most abundant and of its largest size on the western slopes of the Alleghanies of West Virginia; often spreading by underground stems into broad thickets of small and often stunted trees.

Formerly much planted as an ornamental and timber tree in the eastern states; very frequently used in Europe, with numerous seminal varieties of peculiar foliage or habit, for the decoration of parks and gardens, and to shade the streets of cities.

2. Robinia neo-mexicana A. Gray. Locust.

In its typical form a shrub only a few feet high. The hairs on the fruit not glandular-hispid.

Distribution. Mountain cañons and plains, Grant County, New Mexico. Passing into

Robinia neo-mexicana var. luxurians Dieck.

Leaves 6′–12′ long, with a stout pubescent petiole, and 15–21 leaflets; stipules chartaceous, covered with long silky brown hairs, becoming at maturity stout slightly recurved

Fig. 570

flat brown or bright red spines sometimes 1′ or more long; leaflets elliptic-oblong, rounded or sometimes slightly emarginate at the mucronate apex, cuneate or sometimes rounded

at base, $1\frac{1}{2}'$ long, and 1′ broad, coated at first on the lower surface and on the margins with soft brown hairs, and silvery-pubescent on the upper surface, and at maturity thin, pale blue-green, conspicuously reticulate-veined, and glabrous with the exception of the slightly puberulous lower side of the slender midrib and stout petiolule; stipels membranaceous, $\frac{1}{4}'$ long, often recurved, sometimes persistent through the season. **Flowers** appearing in May, 1′ long, on slender pedicels $\frac{1}{2}'$ in length and covered with stout glandular hairs, in short compact many-flowered glandular-hispid long-stemmed racemes; corolla pale rose color or sometimes almost white (f. *albiflora* Kusche), with a broad standard and wing-petals. **Fruit** 3′–4′ long, about $\frac{1}{3}'$ wide, glandular-hispid, with a narrow wing; **seeds** dark brown, slightly mottled, $\frac{1}{16}'$ long.

A tree, sometimes 20°–25° high, with a trunk 6′–8′ in diameter, and branchlets at first pale and coated with rusty brown glandular hairs increasing in length during the summer, and slightly puberulous, bright reddish brown, often covered with a glaucous bloom, and marked by a few small scattered pale lenticels during their first winter. **Bark** of the trunk thin, slightly furrowed, light brown, the surface separating into small plate-like scales. **Wood** heavy, exceedingly hard, strong, close-grained, yellow streaked with brown, with light yellow sapwood of 4 or 5 layers of annual growth.

Distribution. Banks of mountain streams; valley of the Purgatory River, Colorado, through northern New Mexico and Arizona to southern Utah; on the Santa Catalina and Santa Rita Mountains, southern Arizona up to altitudes of 7000°; probably of its largest size near Trinidad, Las Animas County, Colorado.

Occasionally cultivated as an ornamental tree in the eastern states, and in western Europe.

× *Robinia Holdtii* Beiss, a hybrid of *Robinia neo-mexicana* var. *luxurians* and *R. Pseudoacacia*, has appeared in a Colorado nursery and is occasionally cultivated.

3. Robinia viscosa Vent. Clammy Locust.

Leaves 7′–12′ long, with a stout nearly terete dark glandular-hispid clammy petiole, and 13–21 leaflets; stipules subulate, chartaceous, often deciduous or developing into short slender spines; leaflets ovate, sometimes acuminate, mucronate, rounded or pointed

Fig. 571

at apex, and cuneate at base, when they unfold covered below with soft white pubescence, and slightly puberulous above, and at maturity dark green and glabrous on the upper surface, pale and pubescent on the lower surface, especially on the slender yellow midrib and primary veins and on the stout glandular-hispid petiolule, $1\frac{1}{2}'$–2′ long and $\frac{2}{3}'$ wide; stipels slender, deciduous. **Flowers** $\frac{2}{3}'$ long, almost inodorous, appearing in June, on slender

hairy pedicels from the axils of large lanceolate acuminate dark-red bracts contracted at apex into a long setaceous point exserted beyond the flower-buds and mostly deciduous before the flowers open, in short crowded glandular-hispid racemes; calyx dark red, coated on the outer surface and on the margins of the subulate lobes with long pale hairs; corolla pale rose or flesh color, with a narrow standard marked on the inner face by a pale yellow blotch, and broad wing-petals. **Fruit** narrow-winged, glandular-hispid, 2′–3½′ long; **seeds** ⅛′ long, dark reddish brown and mottled.

A tree, 30°–40° high, with a trunk 10′–12′ in diameter, slender spreading branches, and dark reddish brown branchlets covered with conspicuous dark glandular hairs exuding, like those on the petioles and legumes, a clammy, sticky substance, during the first winter bright red-brown, covered with small black lenticels and very sticky, becoming in their second year light brown and dry; or a shrub, often only 5°–6° tall. **Bark** of the trunk ½′ thick, smooth, dark brown tinged with red. **Wood** heavy, hard, close-grained, brown, with light yellow sapwood of 2 or 3 layers of annual growth.

Distribution. Mountains of North and South Carolina up to altitudes of 4000°, and now naturalized in many parts of the United States east of the Mississippi River and as far north as eastern Massachusetts.

Often planted as an ornament of parks and gardens in all countries with a temperate climate.

16. OLNEYA A. Gray.

A tree, with thin scaly bark, and stout terete hoary-canescent slightly angled branchlets armed with stout infrastipular spines. Leaves equally or unequally pinnate, hoary-canescent, persistent, 10–15-foliolulate, destitute of stipules and stipels, short-petiolate, often fascicled in earlier axils; leaflets oblong or obovate, entire, obtuse, often mucronate at apex, cuneate at base, rigid, short-petiolulate, reticulate-veined, with a broad conspicuous midrib. Flowers on stout pedicels rather longer than the calyx, in short axillary few-flowered hoary-canescent racemes, with acute minute bracts and bractlets deciduous before the expansion of the flowers; calyx hoary-canescent, the lobes ovate, obtuse, almost equal, the two upper lobes connate nearly throughout; disk cupuliform, adnate to the tube of the calyx; corolla papilionaceous; petals unguiculate, purple or violet, inserted on the disk; standard orbicular, deeply emarginate, reflexed, furnished at base of the blade with two infolded ear-shaped appendages covering 2 prominent callosites; wing-petals oblique, oblong, slightly auriculate at base of blade on the upper side, free, as long as the broad obtuse incurved keel-petals; stamens 10, the superior stamen free, filling the slit in the tube formed by the union of the others; filaments filiform; anthers of the same length, oblong, uniform; ovary sessile or slightly stipitate, pilose; style inflexed, bearded above the middle; stigma thick and fleshy, depressed-capitate; ovules numerous, suspended from the inner angle of the ovary, superposed. Legume oblique, compressed, glandular-hairy, light brown, 2-valved, often tipped with the remnants of the long persistent style, 1–5-seeded, the valves thick and coriaceous, becoming unequally and interruptedly convex at maturity. Seeds broad-ovoid, slightly angled on the ventral side, suspended by a short thick funicle, without albumen; seed-coat thin, membranaceous, bright chestnut-brown and lustrous; embryo filling the cavity of the seed; cotyledons thick and fleshy, accumbent on the short incurved radicle.

The genus is represented by a single species of southern Arizona, California, and northwestern Mexico.

Olneya is in memory of Stephen T. Olney (1812–1878), author of a catalogue of the plants of Rhode Island.

1. Olneya tesota A. Gray. Ironwood.

Leaves 1′–2½′ long, with leaflets ½′–¾′ in length, appearing in June and persistent until the following spring. **Flowers** unfolding with the leaves, nearly ½′ long. **Fruit** light

brown, very glandular, fully grown at midsummer, ripening before the end of August, 2′–2½′ long.

A tree, sometimes 25°–30° high, with a short trunk occasionally 18′ in diameter and usually divided 4°–6° above the ground into a number of stout upright branches, and slender branchlets thickly coated at first with hoary-canescent pubescence disappearing early in their second year, and then pale green and more or less spotted and streaked with red, becoming pale brown in their third season, their spines straight or slightly curved, very sharp and rigid, ⅛′–¼′ long, and persistent at least during two years. Bark of the

Fig. 572

trunk thin, exfoliating in long longitudinal dark red-brown scales. **Wood** very heavy, hard and strong, although brittle, rich dark brown striped with red, with thin clear yellow sapwood; valued as fuel and sometimes manufactured into canes and other small objects.

Distribution. Sides of low depressions and arroyos in the desert; valley of the Colorado River south of the Mohave Mountains, California, to southwestern Arizona, and to Sonora and Lower California; most abundant and of its largest size in Sonora.

17. ERYTHRINA L.

Trees or shrubs with erect terete stems and branches, often armed with recurved prickles, or rarely herbaceous. Leaves alternate, pinnately 3-foliolate; stipules small, the stipels gland-like. Flowers papilionaceous, showy, in pairs or fascicled on the rachis of axillary leafless racemes, or in terminal racemes furnished at base with leaf-like bracts; calyx oblique, truncate or 5-toothed; corolla usually scarlet; petals free; standard broad or elongated, erect or spreading, nearly sessile or raised on a long stalk; wing-petals small or wanting, longer or shorter than the keel-petals; stamens 10, united into a tube split on the upper side, the tenth and upper stamen separate or all 10 united; anthers uniform; ovary stipitate, 1-celled; styles subulate, incurved, naked; stigmas small, terminal; ovules numerous, amphitropous, the micropyle superior. Fruit a stipitate linear-falcate pod narrowed at ends, compressed or subterete, constricted or undulate between the seeds, 2-valved; seeds reniform, attached by an oblong basal hilum, exalbuminous.

From twenty-five to thirty species are recognized, all inhabitants of tropical and semi-tropical regions. In the gardens of warm countries several of the species are cultivated for the beauty of their large and brilliant flowers.

The name is from *ἐρυθρός*, in allusion to the color of the flowers.

1. Erythrina herbacea var. arborea Chapm.

Leaves persistent, usually 6′–8′ long, with a slender petiole and rachis occasionally armed with small recurved prickles; leaflets thin, deltoid to hastate, concave-cuneate at the broad base, the lateral lobes broad and rounded and much shorter than the elongated terminal lobe gradually narrowed and rounded at apex, thin, yellow-green, smooth and glabrous, $2\frac{1}{4}'$–$3\frac{1}{2}'$ long and $1\frac{1}{2}'$–$2\frac{1}{4}'$ wide; petiolules slender, about $\frac{1}{4}'$ in length, with minute gland-like stipels. **Flowers** $2'$–$2\frac{1}{2}'$ long on short slender pedicels, in narrow leafless racemes 8′–13′ long, the lower flowers fading before those at the apex of the raceme open; calyx dark red, truncate and ciliate at the mouth, $\frac{1}{4}'$ in length; corolla scarlet; the standard narrow, oblanceolate, gradually narrowed into the long base, about $\frac{1}{4}'$ long, closely infolded and then more or less falcate; wing-petals slightly longer than the calyx and longer than

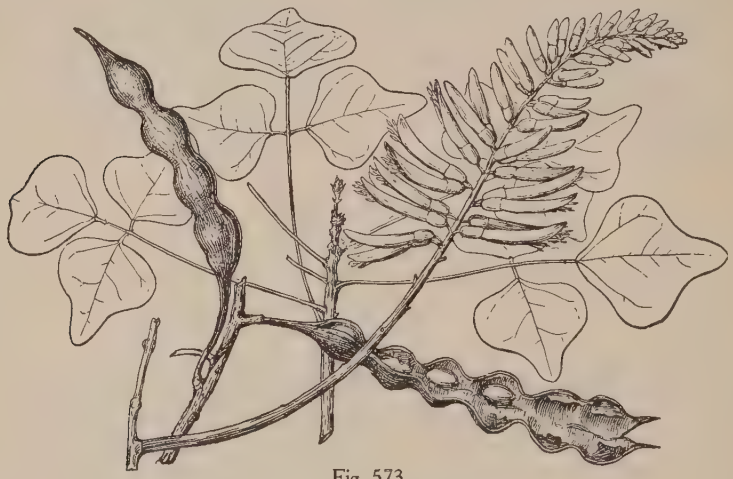

Fig. 573

the keel-petals; stamens diadelphous. **Fruit** compressed, constricted between the seeds, apiculate at apex, from 4′–6′ long, gradually narrowed into a stout stipitate base often $\frac{3}{4}'$ in length; **seeds** compressed, bright scarlet, lustrous, $\frac{5}{12}'$ long and about $\frac{1}{6}'$ wide, with a dark hilum.

A tree, rarely 25°–30° high, with a tall trunk occasionally a foot in diameter, small erect and spreading branches, and slender yellow-green branchlets armed with short broad recurved spines; more often shrubby and, except in size and habit, not distinguishable from *Erythrina herbacea* L., an herb with slender spreading stems occasionally 3° long, and common in sandy soil from the coast region of North Carolina to Florida, western Mississippi and Louisiana, and in the valley of the lower Rio Grande, Texas. **Bark** thin red-brown marked by longitudinal rows of large circular elevated lenticle-like excrescences.

Distribution. Florida, coast region from Miami, Dade County, to the southern shores of Tampa Bay, and on the southern keys.

18. ICHTHYOMETHIA P. Brown.

Trees or shrubs with thin scaly bark and stout terete branchlets without a terminal bud. **Leaves** unequally pinnate, long-petiolate; leaflets opposite. **Flowers** papilionaceous, on slender pedicels enlarged at the end, bibracteolate, in lateral panicles, appearing before the leaves; bracts and bractlets minute, scarious; calyx campanulate, 2-lipped, the

upper lip emarginate, the lower 3-lobed, persistent, the lobes imbricated in the bud, short and broad; petals inserted on an annular glandular disk adnate to the interior of the calyx-tube, unguiculate, white tinged with red, rarely yellowish white; stamens 10, the filament of the upper stamen free at base only, united above with the others into a long tube; anthers oblong, uniform, versatile; ovary sessile, contracted into a filiform incurved style, with a capitate stigma; ovules numerous, suspended from the inner angle of the ovary, 2-ranked. Legume linear, compressed, raised on a stalk longer than the calyx, slightly contracted between the numerous seeds, tomentose-canescent or glabrate, thin-walled, indehiscent, longitudinally 4-winged, the wings developed from the dorsal and ventral sutures, broad or narrow, continuous or interrupted by the abortion of some of the ovules, membranaceous, their margins undulate or irregularly cut; seeds oval, compressed, without albumen, laterally attached by a short thick funicle; seed-coat thin, crustaceous, red-brown, not lustrous; embryo filling the cavity of the seed; cotyledons plano-convex, oval, fleshy; radicle short, inflexed.

Seven or eight species are now recognized, inhabitants of tropical America where they are distributed from southern Florida, through the West Indies to southern Mexico and Guatemala. Piscidia from the bark of the roots of Ichthyomethia is sometimes used medicinally.

The generic name, from ἰχθύς and μέθυ, indicates the Carib use of one of the species.

1. **Ichthyomethia piscipula A. S. Hitch. Jamaica Dogwood.**

Leaves 4′–9′ long, 5–11-foliolate, with stout petioles; leaflets oval, obovate or broad-oblong, obtuse or short-acuminate at apex, rounded or cuneate at base, with thick pubescent petiolules, when they first appear coated like the petioles with rufous hairs, at maturity coriaceous, glabrous and dark green above, pale and more or less clothed below with rufous or canescent pubescence along the elevated conspicuous midrib, and numerous thin veins arching and united at the entire undulate thickened margins, or covered with soft pubescence below; deciduous in spring. **Flowers** opening in May, ¾′ long, on slender pedicels sometimes 1½′ in length, in canescent ovoid densely flowered or elongated thyrsoid panicles, with short 3–12-flowered branches, from the axils of the fallen leaves of the previous year; calyx canescent, 5-lobed; petals white tinged with red, the standard hoary-canescent on the outer surface, marked with a green blotch on the inner surface, its claw as long as the calyx; ovary sericeous. **Fruit** ripening in July and August, broad-winged, light brown, 3′–4′ long and 1′–1½′ across the wings.

Fig. 574

A tree, 40°–50° high, with a trunk often 2°–3° in diameter, stout erect sometimes con-

torted branches forming an irregular head, and branches coated when they first appear with thick rufous pubescence disappearing during their first summer, becoming glabrous or glabrate, bright reddish brown, conspicuously marked by oblong longitudinal lenticels, and large elevated horizontal slightly obcordate leaf-scars marked by the ends of numerous small scattered fibro-vascular bundles. **Winter-buds** ovoid, acute, $\frac{1}{8}'$–$\frac{1}{4}'$ long, with thin hoary-pubescent scales. **Bark** of the trunk about $\frac{1}{8}'$ thick, gray more or less blotched with olive and covered with small square scales. **Wood** very heavy, hard, close-grained, clear yellow-brown, with thick lighter colored sapwood, very durable in contact with the ground; largely used in Florida in boat-building, and for firewood and charcoal. In the West Indies the bark of the roots, young branches and powdered leaves were used by the Caribs to stupefy fish and facilitate their capture.

Distribution. One of the common tropical trees of Florida from the shores of Bay Biscayne to the southern keys, and on the west coast from the neighborhood of Peace River to Cape Sable; on many of the Antilles and in southern Mexico. Sterile branches collected by *C. T. Simpson* in the neighborhood of Cape Sable indicate that a second species occurs in Florida.

XXIV. ZYGOPHYLLACEÆ.

Trees or shrubs, with hard resinous wood, and opposite pinnate leaves, with stipules. Flowers perfect, regular; calyx 5-lobed, the lobes imbricated in the bud; petals as many as the calyx-lobes, imbricated in the bud, hypogynous; stamens twice as many as the petals, hypogynous; filaments distinct; anthers introrse, 2-celled, the cells opening longitudinally; ovary 5-celled; styles united, terminating in a minute 5-lobed or entire stigma; ovules numerous, suspended, anatropous; raphe ventral. Fruit capsular, angled or winged, separating at maturity into 5 indehiscent carpels. Seeds solitary or in pairs in each cell; seed-coat thick and fleshy; embryo straight or nearly so; cotyledons oval, foliaceous; radicle short, superior.

Of the fourteen genera of this family, mostly confined to the warmer parts of the northern hemisphere, one only, Guaiacum, has an arborescent representative in the United States.

1. GUAIACUM L. Lignum-vitæ.

Trees or shrubs, with scaly bark, and stout terete alternate branchlets often with swollen nodes. Leaves petiolate, abruptly pinnate, with 2–14 entire reticulate-veined leaflets, and minute mostly deciduous stipules. Flowers terminal, solitary or umbellate-fascicled, pedicellate, from the axils of minute deciduous bracts; calyx-lobes slightly united at base, unequal, deciduous; petals broad-obovate, more or less unguiculate; stamens inserted on the inconspicuous elevated disk opposite to and alternate with the petals; filaments filiform, naked or bearing at base on the inner surface a minute membranaceous scale; anthers oblong; ovary raised on a short thick stalk, obovoid or clavate, 5-lobed, contracted into a slender subulate acute style; ovules 8–10 in each cell, suspended in pairs from the inner angle. Fruit fleshy, 5-celled, smooth, coriaceous, narrowed at base into a short stem, with 5 wing-like angles, ventrally and sometimes dorsally dehiscent. Seeds suspended, ovoid; seed-coat easily separable from the hard bony nucleus closely invested with a thin indistinct tegumen.

Guaiacum is confined to the New World, and is distributed from southern Florida through the Antilles, Mexico, and Central America to the Andes of Peru. Seven or eight species are distinguished.

Guaiacum produces heavy close-grained wood, the cells of the heartwood filled with dark-colored resin. The lignum-vitæ of commerce, largely used for the sheaths of ship-blocks, mallets, skittle-balls, ten-pin balls, etc., is produced principally by *Guaiacum officinale* L., of the Antilles and South America, and by *Guaiacum sanctum* L. Guaiacum resin is a stimulating diaphoretic sometimes used in the treatment of gout and rheumatism.

The generic name is from the Carib Guaiaco or Guayacon, the aboriginal name of the Lignum-vitæ.

1. Guaiacum sanctum L.

Leaves 3′ or 4′ long, with 3 or 4 pairs of obliquely oblong or obovate mucronate subsessile leaflets, membranaceous, light green and puberulous below when they first appear, becoming subcoriaceous, glabrous, dark green and lustrous on both surfaces, 1′ long and nearly ½′ wide, persistent until the appearance of the new growth in March or early April of the following year; stipules acuminate, tipped with a short mucro, pubescent, ⅛′ long, usually caducous, but sometimes persistent during the season. **Flowers** ⅔′ in diameter, opening almost immediately after the appearance of the new growth, and continuing to open during several weeks, solitary on a slender pubescent pedicel shorter than the leaves and usually produced 3 or 4 together at the end of the branches from the axils of the upper leaves, their bracts acuminate, minute, the 2 lateral rather smaller than the others; calyx-lobes obovate, slightly pubescent, especially on the outer surface near the base, and smaller

Fig. 575

than the blue petals twisted below from left to right, and thus appearing to be obliquely inserted; filaments naked; ovary obovoid, prominently 5-angled, glabrous, contracted at base into a short stout stalk. **Fruit** broad-obovoid, ¾′ long, ½′ wide, bright orange color, opening at maturity by the splitting of the thick rather fleshy valves; **seeds** black, with a thick fleshy scarlet aril-like outer coat.

A gnarled round-headed tree, sometimes 25°–30° high, with a short stout trunk occasionally 2½°–3° in diameter, slender pendulous branches, and branchlets conspicuously enlarged at the nodes, slightly angled, pubescent when they first appear, becoming in their second year glabrous, nearly white, and roughened by numerous small excrescences. **Bark** of the trunk rarely more than ⅛′ thick, separating on the surface into thin white scales. **Wood** dark green or yellow-brown, with thin clear yellow sapwood.

Distribution. Keys of southern Florida from Key West eastward; on the Bahama Islands and on several of the Antilles.

XXV. MALPIGHIACEÆ.

Trees, shrubs or vines with opposite simple entire often stipulate persistent leaves; stipules deciduous or 0. Flowers usually perfect or dimorphous, on pedicels articulate near their base from the axils of a bract and furnished below the articulation with two bractlets, in terminal racemes, corymbs or umbels; calyx 5-lobed, the lobes generally im-

bricated in the bud, usually glandular; petals 5, convolute in the bud, unguiculate; disk inconspicuous; stamens usually 10; filaments generally united at base; anthers short, 2-celled, introrse; ovary of 3 rarely of 2 carpels more or less united into a 3-celled ovary; styles usually 3, distinct, rarely united; stigma terminal or sublateral, inconspicuous; ovule solitary, between orthotropous and anatropous, often uncinate, ascending on the pendulous funicle; raphe ventral; micropyle superior. Fruit drupaceous or samaroid; seeds without albumen, suspended from below the apex of the cell; testa thin; embryo curved or coiled, rarely straight; cotyledons often unequal; radicle short, superior.

This family of nearly sixty genera is confined to tropical and subtropical America, with one arborescent species in the United States.

1. BYRSONIMA Rich.

Trees, or shrubs often scandent, with astringent bark and leaves; stipules usually connate, rarely partly connate or free. Flowers in terminal racemes; lobes of the calyx furnished on the back with two glands; petals unguiculate, their slender claws reflexed in anthesis, the limb concave, penniveined; stamens 10, filaments short, united and bearded at base; ovary 3-celled; styles 3, distinct, oblong or subulate, gradually narrowed into the acute stigma. Fruit a 3-celled drupe; endocarp bony or woody, angled; seeds ovoid to subglobose; embryo circinate, with slender coiled cotyledons; radicle oblong.

Byrsonima with nearly one hundred species is widely distributed in tropical America from southern Florida, where one species occurs, and the Bahama Islands through the West Indies, Mexico, Brazil and Bolivia.

The generic name is from *βύρς*, a hide, in allusion to the use of the bark in tanning.

1. Byrsonima lucida DC.

Leaves oblong-obovate, rounded or occasionally abruptly short-pointed at apex, gradually narrowed and cuneate at base, coriaceous, glabrous, dark green and lustrous above,

Fig. 576

paler, dull and reticulate-venulose beneath, 1′–1½′ long and ¼′–½′ wide, with thickened revolute margins, a slender midrib and obscure primary veins; petioles stout, ⅛′–¼′ in length; stipules free, minute, acute, deciduous. **Flowers** ¼′ in diameter, appearing through-

out the year on slender puberulous pedicels $\frac{1}{4}'$ to nearly $\frac{1}{2}'$ long from the axils of acuminate caducous bracts a third longer than their acuminate bractlets, in terminal 5–12-flowered erect racemes $\frac{3}{4}'$–$1\frac{1}{2}'$ in length; calyx cup-shaped, persistent under the fruit, with short nearly triangular lobes much shorter than the white petals turning yellow, pink or rose color; styles elongated and persistent on the fruit. Fruit subglobose, greenish, about $\frac{1}{4}'$ in diameter, the flesh thin and dry; stone woody, rugose, thick-walled, lustrous on the inner surface; seed ovoid, acute, filling the cavity of the stone, pale yellow.

A small tree, rarely 20° high with a trunk 10′ in diameter, covered with pale bark, spreading branches forming a flat-topped head and slender terete pale gray branchlets; more often a many-stemmed shrub.

Distribution. Florida, in limestone soil on the Everglade Keys, Dade County, and on several of the southern keys; on the Bahamas and many of the Antilles; in Florida arborescent on Long Key in the Everglades, and on Big Pine Key.

XXVI. RUTACEÆ.

Trees or shrubs, abounding in a pungent or bitter aromatic volatile oil, with simple or compound usually glandular-punctate leaves, without stipules or rarely with stipular spines. Flowers regular, perfect or unisexual, in paniculate or corymbose cymes; calyx 3–5-lobed, the lobes more or less united at base, imbricated in the bud; petals 3–5, imbricated in the bud; stamens as many or twice as many as the petals; filaments distinct or united below; anthers introrse, 2-celled, the cells opening longitudinally; pistils 1–4, separate or united into a compound ovary sessile or stipitate on a glandular disk; styles mostly united; ovules usually 2 in each cell of the ovary, pendulous, anatropous or amphitropous; raphe ventral; micropyle superior. Fruit of 2-valved carpels, a samara, drupe or capsule. Seeds solitary or several; seed-coat bony or crustaceous, furrowed or punctate; embryo axile in fleshy albumen; radicle short, superior.

Of this large family, widely distributed over the warm and temperate parts of the earth's surface, four genera only have arborescent representatives in the United States. *Citrus Aurantium* L., the Bitter-sweet Orange, a native of Asia, has long been naturalized in the peninsula of Florida, where other species of this genus have escaped from cultivation and are now growing spontaneously.

CONSPECTUS OF THE ARBORESCENT GENERA OF THE UNITED STATES.

Fruit of 1–5, 2-valved 1-seeded carpels; flowers dicœcious or polygamous.	1. **Xanthoxylum.**
Fruit of 3 or 4-winged indehiscent 1-seeded carpels; flowers perfect.	2. **Helietta.**
Fruit a winged samara; flowers polygamous.	3. **Ptelea.**
Fruit a 1-seeded drupe; flowers perfect or polygamous.	4. **Amyris.**

1. XANTHOXYLUM L.

Trees or shrubs, with acrid aromatic bark, pellucid aromatic-punctate fruit and foliage, scaly buds, and usually stipular spines. Leaves alternate, unequally or rarely equally pinnate; leaflets generally opposite, often oblique at the base, entire or crenulate. Flowers small, dicœcious or polygamous, in axillary or terminal broad or contracted pedunculate cymes; calyx and petals hypogynous; disk small or obscure; stamens as many as the petals and alternate with them, hypogynous, effete, rudimentary or wanting in the female flower; filaments filiform or subulate; pistils 1–5, oblique, raised on the summit of a fleshy gynophore, connivent, sometimes slightly united below, rudimentary, simple or 2–5-parted in the sterile flower; ovaries 1-celled; styles short and slender, more or less united toward the summit; stigmas capitate; ovules collateral, pendulous from the inner angle of the cell. Fruit of 1–5 coriaceous or fleshy 1-seeded carpels, broad-obovoid, sessile or stipitate, ventrally dehiscent. Seed solitary oblong or globose, suspended on a slender funicle, often

hanging from the carpel at maturity; seed-coat black, shining, conspicuously marked by the broad hilum; cotyledons oval or orbicular, foliaceous.

Xanthoxylum is widely distributed through tropical and extratropical regions and is most abundant in tropical America. It is represented in North America by one shrub and by four arborescent species of the southern states. The resin contained in the bark, especially in that of the roots, is a powerful stimulant and tonic occasionally used in medicine.

The generic name is from ξανθός and ξύλον.

CONSPECTUS OF THE ARBORESCENT SPECIES OF THE UNITED STATES.

Flowers in axillary contracted cymes; branches armed with stipular spines.
1. **X. Fagara** (D, E).

Flowers in terminal cymes.
Calyx-lobes and petals 5; leaves unequally pinnate.
Leaves deciduous; branches armed with stout spines. 2. **X. clava-Herculis** (C).
Leaves persistent; branches without spines. 3. **X. flavum** (D).
Calyx-lobes and petals 3; leaves equally pinnate, persistent. 4. **X. coriaceum** (D).

1. Xanthoxylum Fagara Sarg. Wild Lime.

Fagara Fagara Small.

Leaves persistent, 3′–4′ long, with a broad-winged jointed petiole, and 7–9 obovate leaflets rounded or emarginate at apex, minutely crenulate-toothed above the middle, sessile,

Fig. 577

½′ long or less, coriaceous, glandular-punctate, bright green and lustrous, with minute hooked deciduous stipular prickles. **Flowers** on short pedicels from the axils of minute ovate obtuse deciduous bracts, in short axillary contracted cymes, appearing singly or in pairs from April until June, on branches of the previous year, from minute dark brown globular buds, the staminate and pistillate flowers on different trees; sepals 4, membranaceous, much shorter than the 4 ovate yellow-green petals; stamens 4, with slender exserted filaments, 0 in the pistillate flower; pistils 2, with ovate sessile ovaries gradually contracted into long slender subulate exserted styles united near apex and crowned with obliquely spreading stigmas, rudimentary in the staminate flower. **Fruit** ripening in September, obovoid, rusty brown and rugose, ⅛′–¼′ long; **seed** dark and lustrous.

A tree, occasionally 25°–30° high, with a slender often inclining trunk, fastigiate branches, and more or less zigzag slender dark gray branchlets armed with sharp hooked stipular

spines; more frequently a tall or low shrub. **Bark** of the trunk about $\frac{1}{8}'$ thick, the smooth light gray surface broken into small appressed persistent scales. **Wood** heavy, hard, very close-grained, brown tinged with red, with thin yellow sapwood of 10-12 layers of annual growth.

Distribution. Coast and islands of southern Florida, and Texas from Matagorda Bay to the Rio Grande and in San Saba, Bandera, and Brown Counties; one of the commonest of the south Florida plants, and arborescent on the rich hummock soil of Elliott's Key and the shores of Bay Biscayne; in Texas generally shrubby; common in northern Mexico, and widely distributed through the Antilles, southern Mexico, and Central and South America to Brazil and Peru.

2. Xanthoxylum clava-Herculis L. Prickly Ash. Toothache-tree.

Fagara clava-Herculis Small.

Leaves 5′–8′ long, with a stout pubescent or glabrous spiny petiole, and 3–9 pairs of ovate or ovate-lanceolate sometimes slightly falcate subcoriaceous leaflets usually oblique at base, crenulate-serrate, sessile or short-stalked, 1′–$2\frac{1}{2}'$ long, green and lustrous above, paler and often somewhat pubescent below, especially when they unfold; persistent until

Fig. 578

late in the winter or until the appearance of the new leaves in the early spring. **Flowers** on slender pedicels $\frac{1}{3}'$–$\frac{1}{4}'$ long, from the axils of minute lanceolate deciduous bracts, in ample wide-branched cymes 4′–5′ long and 2′–3′ wide, appearing in very early spring, when the leaves are about half grown, the staminate and pistillate flowers on different individuals; sepals minute, membranaceous, persistent, barely one fourth the length of the oval green petals $\frac{1}{8}'$–$\frac{1}{4}'$ long; stamens 5, with slender filiform filaments, conspicuously exserted from the male flowers, rudimentary or wanting in the female flowers; pistils 3, rarely 2, with sessile ovaries and short styles crowned by a slightly 2-lobed stigma. **Fruit** ripening in May and June, in dense often nearly globose clusters; mature carpels obliquely ovoid, 1-seeded, chestnut-brown, $\frac{1}{4}'$ long, with a rugose or pitted surface; **seeds** hanging at maturity outside the carpels.

A round-headed tree, 25°–30°, or exceptionally 50° high, with a short trunk 12′–18′ in diameter, numerous branches spreading nearly at right angles, and stout branchlets covered when they first appear with brown pubescence, becoming glabrous and light gray in their second year, and marked by small glandular spots and by large elevated obcordate leaf-scars displaying a row of large fibro-vascular bundle-scars, and armed with stout straight or sometimes slightly curved sharp chestnut-brown spines $\frac{1}{2}'$ or more long, with a

flattened enlarged base; or often a low shrub. **Winter-buds** short, obtuse, dark brown or nearly black. **Bark** of the trunk barely $\frac{1}{16}'$ thick, light gray, and roughened by corky tubercles, with ovoid dilated bases sometimes 1′ or more across and thick and rounded at apex. **Wood** light, soft, close-grained, and light brown, with yellow sapwood. The bark, which is collected in large quantities by negroes in the southern states, is used as a cure for toothache and in the treatment of rheumatism.

Distribution. Southeastern Virginia southward near the coast to the shores of Bay Biscayne and Bocagrande, Lee County, Florida, and westward through the Gulf states to northern Louisiana, southern Arkansas (near Arkadelphia, Clark County), and eastern Oklahoma, and through Texas to the valley of the Colorado River ranging northward to Tarrant and Dallas Counties; in the Atlantic states not abundant, and confined to the immediate neighborhood of the coast, growing in light sandy soil and often on the low bluffs of islands or on river banks; from the Gulf coast ranging farther inland, especially west of the Mississippi River; most abundant in eastern Texas, and of its largest size on the rich intervale lands of the streams flowing into the Trinity River. In western Texas a form occurs (var. *fruticosum* Gray), with short sometimes 3-foliolate more or less pubescent leaves, with small ovate or oblong blunt and conspicuous crenulate rather coriaceous leaflets; this is the common form of western Texas, growing usually as a low shrub.

3. Xanthoxylum flavum Vahl. Satinwood.

Fagara flava Kr. & Urb.

Leaves unequally pinnate, persistent, usually 6′–9′ long, with a stout glandular petiole enlarged at base, and usually 5, sometimes 3, or rarely 1 leaflet, unfolding in Florida during the month of June, and then densely covered with tomentum, and at maturity sparingly

Fig. 579

hairy on the petiole and on the midrib of the ovate-lanceolate or elliptic, obtuse, often slightly falcate leaflets, sometimes oblique at base, nearly sessile or long-stalked, 2′–3′ long, $1\frac{1}{2}'$–2′ broad, entire or slightly crenulate, coriaceous, pale yellow-green and conspicuously marked by large pellucid glands. **Flowers** appearing in Florida in June, on a slender pubescent pedicel $\frac{1}{4}'$ or more long, in wide-spreading pubescent sessile cymes, the male and female on different trees; calyx-lobes 5, minute, acuminate, ciliate on the margins, barely one eighth of the length of the ovate greenish white petals reflexed when the flowers are fully expanded; stamens 5, with slender filaments much longer than the petals, 0 in the pistillate flower; pistils 2 or sometimes 1, with a stipitate obovate ovary and a short style with a spreading entire stigma, minute and depressed in the staminate flower. **Fruit** ripening in autumn and early winter and sometimes persistent until the

spring of the following year; mature carpels obliquely obovoid, short-stalked, 1-seeded, pale chestnut-brown at maturity, about $\frac{1}{3}'$ long, faintly marked by minute glands.

A round-headed tree, 30°–35° high, with a trunk 12′–18′ in diameter, and stout brittle branchlets coated at first with thick silky pubescence, becoming light gray, rugose, conspicuously marked by large triangular leaf-scars, and puberulous during their second and third years. **Winter-buds** narrow-acuminate, $\frac{1}{2}'$ long, coated with short thick pale tomentum. **Bark** of the trunk $\frac{1}{4}'$ thick, with a smooth light gray surface divided by shallow furrows and broken into numerous short appressed scales. **Wood** very heavy, exceedingly hard, brittle, not strong, light orange-colored, with thin rather lighter colored sapwood; occasionally used in southern Florida in the manufacture of furniture, for the handles of tools, and other objects of domestic use.

Distribution. Florida, on the Marquesas Keys and on South Bahia Honda and Boca Chica Keys; on Bermuda, the Bahama Islands, San Domingo, and Porto Rico.

4. Xanthoxylum coriaceum A. Richard.

Fagara coriacea Kr. & Urb.

Leaves equally pinnate, persistent, 2′–3′ long, with a stout grooved petiole, and 6–8 oblong-obovate stalked coriaceous dark yellow-green lustrous leaflets rounded or rarely emarginate at apex, 1′–$1\frac{3}{4}'$ long and $\frac{5}{8}'$–$\frac{3}{4}'$ wide, with much-thickened revolute entire margins,

Fig. 580

a stout midrib, slender obscure spreading primary veins, and reticulate veinlets. **Flowers** yellow, appearing in March on short stout pedicels, in densely flowered terminal cymes; sepals 3, minute, united below, free above, much shorter than the 3 oval or obovate petals rounded at apex; stamens 3; filaments about as long as the petals; anthers ovoid or oval; ovary 3-celled, globose-ovoid; styles thick, 3 (*teste Urban*). **Fruit**: mature fruit not seen.

A glabrous tree, sometimes 18°–20° high, with a slender stem, and stout red-brown branches unarmed in Florida specimens, or in the West Indies furnished with short recurved spines; more often shrubby.

Distribution. Florida, shores of Bay Biscayne and near Fort Lauderdale, Dade County; rare; on the Bahama Islands and in Cuba.

2. HELIETTA Tul.

Trees or shrubs, with slender terete branchlets. Leaves opposite, long-petiolate, trifoliolate, persistent; leaflets sessile, obovate-oblong, obtuse, entire or crenate, subcoriaceous,

grandular-punctate, the terminal the largest. Flowers regular, perfect, on slender bibracteolate pedicels, in terminal or axillary panicles; calyx 3 or 4-parted, the divisions imbricated in the bud, slightly united at base, persistent; petals 3 or 4, imbricated in the bud, hypogynous, oblong, concave, glandular-punctate, reflexed at maturity; stamens as many as the petals inserted under the disk; filaments shorter than the petals, slightly flattened, glabrous; anthers ovoid, cordate at base, attached on the back below the middle; disk free, cup-shaped, erect, subcorrugated, with a sinuate margin, 4-lobed, the lobes entire or crenate and opposite the petals; ovary minute, sessile, depressed, 3 or 4-lobed, glandular-verrucose or minutely pilose, the lateral lobes slightly compressed, 4-celled; styles united into a single slender column crowned by the globose 3–4-lobed stigma; ovules collateral, anatropous. Fruit obconic, composed of 3 or 4 dry woody 1-seeded indehiscent carpels with a cartilaginous endocarp and with a prominent horizontal wing, separating at maturity. Seed linear-oblong, seed-coat crustaceous, fragile, black; cotyledons straight, obtuse.

Helietta is distributed from the valley of the lower Rio Grande in Texas to Brazil and Paraguay. Four species are recognized, one species extending across the Rio Grande into western Texas.

The generic name is in honor of Lewis Théodore Hélie (1804–1867), a distinguished French physician.

1. Helietta parvifolia Benth.

Leaves 1½′–2′ long, with a stout slightly club-shaped petiole, at first puberulent, soon becoming glabrous, and oblong or narrow-obovate leaflets rounded or sometimes slightly

Fig. 581

emarginate at apex, gradually and regularly contracted at base, entire or slightly and remotely crenulate-serrate, yellow-green and lustrous above, paler below, conspicuously marked by black glandular dots, the terminal leaflet ½′–1½′ long, sometimes ½′ wide, and nearly twice as large as the others; persistent on the branches until early spring. **Flowers** appearing in April and May, on slender pedicels covered at first like the petioles and calyx with short dense pubescence, with minute acuminate early deciduous bracts, in dichotymously branched subsessile panicles on branchlets of the year from the axils of the upper leaves; petals 4, white, ovate, ⅛′ long, with scattered hairs on the outer surface, and thin scabrous margins, and four or five times longer than the 4 calyx-lobes; stamens 4; ovary 4-lobed, glandular-punctate like the slender style. **Fruit** ripening in October, oblong, ¼′–⅓′ long, with a rigid broad-ovate sometimes slightly falcate wing rounded at apex, ½′ long, and conspicuously reticulate-veined.

A slender tree, 20°–25° high, with a trunk 5′–6′ in diameter, rather erect branches form-

ing a small irregular head, and slender pale branchlets covered with minute wart-like excrescences, slightly puberulous when they first appear, soon becoming glabrous, and marked during their second year by small inconspicuous leaf-scars; or a low shrub. **Bark** of the trunk about $\frac{1}{8}'$ thick, covered with dark brown closely appressed scales separating in large irregular patches and leaving when they fall a smooth pale yellow surface. **Wood** hard, very heavy, close-grained, light orange-brown, with rather lighter colored sapwood.

Distribution. Often forming thickets of considerable extent and abundant near Rio Grande, Starr County, Texas; mesas south of the lower Rio Grande; of its largest size and tree-like in habit on the limestone ridges of the Sierra Madre of Nuevo Leon.

3. PTELEA L.

Small unarmed trees or shrubs, with smooth bitter bark, slender terete branchlets, without terminal buds, small depressed lateral buds covered with pale tomentum, and nearly inclosed by the narrow obcordate leaf-scars marked by the ends of 2 or 3 small fibro-vascular bundles, and thick fleshy acrid roots. Leaves alternate or rarely opposite, without stipules, long-petiolate, usually trifoliolate, the leaflets conduplicate in the bud, ovate or oblong, entire or crenulate-serrate, punctate with pellucid dots. Flowers polygamous, on slender bracteolate pedicels, in terminal or compound cymes, greenish white; calyx 4 or 5-parted; petals 4 or 5, hypogynous; stamens 3 or 4, alternate with and as long as the petals, hypogynous, much shorter in the pistillate flower with imperfect or rudimentary anthers; filaments subulate, more or less pilose, especially toward the base; anthers ovoid or cordate; pistil raised on a short gynophore, abortive and nearly sessile in the staminate flower; ovary compressed, 2–3-celled; style short; stigma 2–3-lobed; ovules superposed, amphitropous, the upper ovule only fertilized. Fruit a 2 or 3-celled broad-winged indehiscent samara surrounded by a reticulate wing or rarely wingless. Seed oblong, acute at apex, rounded at base, ascending; seed-coat smooth or slightly wrinkled, coriaceous; cotyledons ovate-oblong.

Ptelea is confined to the United States and Mexico, where four or five species are known; of these one is a small tree. The bark and foliage of Ptelea is bitter and strong-scented and possesses tonic properties.

The generic name is from πτελέα, a classical name of the Elm-tree.

1. Ptelea trifoliata L. Hop-tree. Wafer Ash.

Leaves rarely 5-foliolate on vigorous shoots; leaflets sessile, ovate or oblong, pointed, the terminal leaflet generally larger and more gradually contracted at base than the others,

Fig. 582

entire or finely serrate, covered at first with short close pubescence, becoming glabrous and rather coriaceous at maturity, dark green and lustrous above, pale below, 4′–6′ long, 2½′–3′ wide, with a prominent midrib and primary veins; turning clear yellow in the autumn before falling; petioles stout, thickened at base, 2½′–3′ in length. **Flowers** appearing in early spring on slender pubescent pedicels 1′–1½′ long, the pistillate and staminate flowers produced together, the staminate usually less numerous and falling soon after the opening of the anther-cells; calyx and petals pubescent; ovary puberulous. **Fruit** with a thin almost orbicular sometimes slightly obovate wing, nearly 1′ across, on a long slender reflexed pedicel, in dense drooping clusters remaining on the branches through the winter; **seeds** ⅓′ long, dark red-brown.

A round-headed tree, rarely 20°–25° high, with a straight slender trunk 6′–8′ in diameter, small spreading or erect branches, and slender branchlets covered at first with short fine pubescence, becoming glabrous, dark brown and lustrous, and marked by wart-like excrescences and by the conspicuous leaf-scars; more often a low spreading shrub. **Winter-buds** depressed, nearly round, pale or almost white. **Wood** heavy, hard, close-grained, yellow-brown, with thin hardly distinguishable sapwood of 6–8 layers of annual growth. The bitter bark of the roots is sometimes used in the form of tinctures and fluid extracts as a tonic, and the fruit is occasionally employed domestically as a substitute for hops in brewing beer.

Distribution. Generally on rocky slopes near the borders of the forest, often in the shade of other trees; Long Island, New York, Pennsylvania, and westward through southwestern Ontario (Point Pelee) and southern Michigan to southern Iowa, southeastern Nebraska, and southward to Georgia, Alabama, eastern Louisiana and through Missouri and Arkansas to southeastern Kansas, eastern Oklahoma and eastern Texas. A form with leaflets soft-pubescent on the lower surface (var. *mollis* T. & G.) occurs in the south Atlantic states from North Carolina to Florida.

Often planted as an ornament of parks and gardens.

4. AMYRIS L.

Glabrous glandular-punctate trees or shrubs, with balsamic resinous juices. Leaves opposite or rarely opposite and alternate, 3-foliolate, without stipules, persistent; leaflets opposite, petiolulate, entire or crenate. Flowers white, minute, on slender bibracteolate pedicels, usually in 3-flowered corymbs in terminal or axillary branched panicles; calyx 4-toothed, persistent; petals 4, hypogynous, much larger than the calyx-lobes, spreading at maturity; disk of the staminate flower inconspicuous, that of the pistillate and perfect flowers thickened and pulvinate; stamens 8, hypogynous, opposite and alternate with the petals; filaments filiform, exserted; anthers ovoid, attached on the back below the middle; ovary ellipsoid or ovoid, 1-celled, rudimentary in the staminate flower; style short, terminal, or wanting; stigma capitate; ovules collateral, suspended near the apex of the ovary, anatropous. Fruit a globose or ovoid aromatic drupe; stone 1-seeded by abortion, chartaceous. Seed pendulous, without albumen; seed-coat membranaceous; cotyledons plano-convex, fleshy, glandular-punctate.

Amyris is confined to tropical America and northern Mexico. Of the twelve or fourteen species which have been distinguished two extend into the territory of the United States; one of these is a small West Indian tree common on the shores of southern Florida, and the other, *Amyris parvifolia* A. Gray, a Mexican shrub, grows in Texas near Corpus Christi, Neuces County, and near the mouth of the Rio Grande. Amyris is fragrant and yields a balsamic aromatic and stimulant resin, and heavy hard close-grained wood valuable as fuel and sometimes used in cabinet-making.

The generic name, from *μύρρα*, relates to the balsamic properties of the plants of this genus.

1. Amyris elemifera L. Torch Wood.

Leaves 3-foliolate, with slender petioles 1′–1½′ long, and broad-ovate or rounded obtuse acute or acuminate leaflets cuneate at base, or sometimes ovate-lanceolate or rhombic-

lanceolate, entire or remotely crenulate, coriaceous, lustrous, dark yellow-green, conspicuously reticulate-veined, covered below with minute glandular dots, 1′–2½′ long, with slender petiolules, that of the terminal leaflet often 1′ or more long and twice as long as those of the lateral leaflets. **Flowers** in terminal pedunculate or nearly sessile panicles appearing in Florida from August to December. **Fruit** ripening in the spring, ovoid, often nearly ½′ long, black covered with a glaucous bloom, with thin flesh filled with an aromatic oil and of rather agreeable flavor.

A slender tree, 40°–50° high, with a trunk sometimes, although rarely, a foot in diameter, and slender terete branchlets covered with wart-like excrescences, at first light brown, becoming gray during their second season. **Bark** of the trunk thin, gray-brown, slightly furrowed and broken into short appressed scales. **Winter-buds** acute, flattened, ⅛′ long, with broad-ovate scales slightly keeled on the back. **Wood** heavy, exceedingly hard, strong, close-grained, very resinous, extremely durable, light orange color, with thin rather lighter colored sapwood of 12–15 layers of annual growth; often used as fuel.

Fig. 583

Distribution. Florida, Mosquito Inlet, Volusia County, to the southern keys; common in the immediate neighborhood of the coast to the rich hummocks of the interior, and of its largest size on Umbrella Key; on the Bahama Islands and on many of the Antilles.

XXVII. SIMAROUBACEÆ.

Trees or shrubs, with bitter juice. Leaves alternate, pinnate, persistent, without stipules. Flowers regular, diœcious; calyx 5-lobed, the lobes imbricated in the bud; petals 5, imbricated in the bud, hypogynous; stamens 10, inserted under the disk; pistil of 5 united carpels; ovary 5-celled; ovule solitary in each cell, anatropous; raphe ventral; micropyle superior. Fruit a drupe.

Of the thirty genera of this family, confined chiefly to the tropics and to the warmer parts of the northern hemisphere, three have arborescent representatives in the flora of North America. *Ailanthus altissima* Swing., the so-called Tree of Heaven, a native of northern China, has been largely planted as an ornament and shade tree in the eastern United States, and is now sparingly naturalized southward.

CONSPECTUS OF THE ARBORESCENT GENERA OF THE UNITED STATES.

Fruit a drupe or berry.

Ovary deeply 5-lobed; fruit drupaceous. — 1. **Simarouba** (D).

Ovary not lobed; fruit baccate. — 2. **Picramnia** (D).

Fruit a 3-winged samara. — 3. **Alvaradoa** (D).

1. SIMAROUBA Aubl.

Trees, with resinous juice and tonic properties. Leaves long-petiolate, abruptly pinnate; leaflets usually alternate, long-petiolulate, conduplicate in the bud, entire, coriaceous, glabrous or slightly puberulous below, feather-veined. Flowers in elongated widely branched axillary and terminal panicles; disk cup-shaped, depressed in the sterile flower, pubescent; stamens as long as the petals, in the pistillate flower reduced to minute scales; filaments free, filiform, thickened toward the base, inserted on the back of a minute ciliate scale; anthers oblong, slightly emarginate, introrse, attached on the back below the middle, 2-celled, the cells opening longitudinally; ovary sessile on the disk, deeply lobed, the lobes opposite the petals, rudimentary, lobulate, minute or wanting in the staminate flower; styles united into a short column, with a 3–5-lobed spreading stigma. Fruit composed of 1–5 sessile spreading drupes; flesh thin; stone crustaceous. Seeds inverse, without albumen; seed-coat membranaceous; cotyledons plano-convex, fleshy, the radicle very short, partly included between the cotyledons, superior.

Simarouba with four species is confined to tropical America, and is distributed from the coast of southern Florida to Brazil and Guatemala. The plants of this genus contain a small amount of resin, a volatile oil, and an exceedingly bitter principle, quasin, with tonic properties.

The generic name is formed from Simarouba, the Carib name of one of the species.

1. Simarouba glauca DC. Paradise-tree.

Leaves 6′–10′ long, glabrous, with a stout petiole 2′–3′ in length, and usually 6 pairs of opposite or alternate oblong-obovate or oval leaflets, rounded or slightly mucronate at apex, usually oblique at base, membranaceous and dark red when they first unfold, soon becoming coriaceous, dark green and very lustrous above, pale and glaucous below, 2′–3′ long and 1′–1½′ wide, with revolute margins, a prominent midrib, remote conspicuous primary veins, and stout petiolules ¼′–½′ in length. **Flowers** appearing in early spring, ⅛′–¼′ long, on short stout club-shaped pedicels, in panicles 12′–18′ long, and 18′–24′ broad, with a

Fig. 584

stout pale glaucous stem and spreading branches from the axils of small acute scarious deciduous bracts; petals fleshy, oval, often acute, pale yellow, and four or five times as long as the glaucous calyx. **Fruit** nearly fully grown by the end of April and then bright scarlet, about 1′ long, ovoid, sometimes falcate, and slightly angled on the ventral suture, becoming dark purple when fully ripe; **seeds** papillose, orange-brown, about ¾′ long.

A round-headed tree, growing occasionally in Florida to the height of 50°, with a straight

trunk 18′–20′ in diameter, slender spreading branches, and stout glabrous branchlets pale green when they first appear, becoming light brown before the end of the summer, rugose and conspicuously marked during their second season by the large oval leaf-scars. **Bark** of the trunk $\frac{1}{2}$′–$\frac{3}{4}$′ thick, light red-brown and broken on the surface into broad thick appressed scales. **Wood** light, soft, close-grained, light brown, with thick rather darker colored sapwood.

Distribution. Florida, from Cape Canaveral and the shores of Bay Biscayne to the southern keys; in Cuba, Jamaica, Nicaragua, and Brazil.

2. PICRAMNIA Sw.

Trees or shrubs, with bitter principles and slender terete branchlets. Leaves alternate, unequally pinnate, persistent, the leaflets subopposite to alternate, entire. Flowers dicœcious, occasionally perfect, small, glomerate on long pendulous spikes or racemes opposite the leaves; calyx 3–5-parted, the lobes imbricated in the bud; petals 3–5, imbricated in the bud, rarely wanting; stamens 3–5, opposite the petals, inserted under the lobed depressed disk, in the pistillate flower reduced to linear scales or wanting; filaments naked; anthers 2-celled, introrse, the cells opening longitudinally; ovary inserted on the disk, 2 or 3-celled, rudimentary in the staminate flower; style 2 or 3-lobed, the lobes recurved and stigmatic on the inner surface, or crowned by a 2 or 3-lobed sessile stigma; ovules 2 in each cell, collateral, attached at the inner angle of the cell near its apex, anatropous; raphe narrow; micropyle superior. Fruit baccate, oblong to oblong-obovoid, 2 or by abortion 1-celled, the cells 1-seeded. Seeds filling the cavity of the cell, plano-convex, pendulous from the apex of the cell; hilum minute, apical, the raphe conspicuous; testa membranaceous, adherent to the exalbuminous undivided embryo; radicle superior, inconspicuous.

Picramnia, with about twenty species, is confined to the tropical and subtropical regions of the New World, one species extending into southern Florida. The bitter principle in the plants of this genus makes the bark of several of them useful in domestic remedies.

The generic name, from *πικρός* and *θάμνος*, is in reference to this bitter principle.

1. Picramnia pentandra Sw.

Leaves 8′–12′ long, 5–9-foliolate, with a slender rachis and petiole; leaflets ovate-oblong, abruptly acuminate at apex, gradually narrowed and cuneate at base, coriaceous, glabrous,

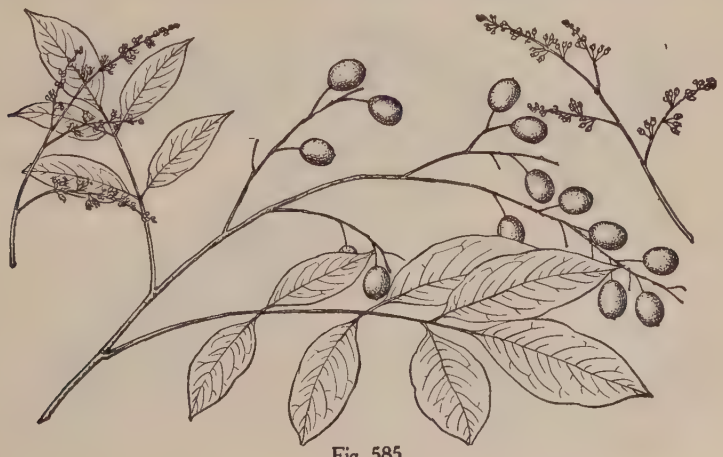

Fig. 585

dark green and lustrous above, $1\frac{1}{2}'$–$2\frac{1}{2}'$ long and $\frac{3}{4}'$–$1'$ wide, with thickened slightly revolute margins, a prominent midrib, slender primary veins and thin reticulate veinlets; petiolules stout, $\frac{1}{12}'$–$\frac{1}{6}'$ long, that of the terminal leaflet often $\frac{3}{4}'$ in length. **Flowers** green on short slender pedicels, in slender pubescent racemes 6′–8′ in length; calyx 5-lobed, the lobes oblong-ovate, acuminate, coated on the outer surface with pale hairs; petals 5, acuminate, hirsute, narrower and longer than the calyx-lobes; stamens 5 in the pistillate flower; filaments slender, glabrous, exserted; anthers short-oblong, obtuse; stigma sessile, 2 or 3-lobed. **Fruit** red becoming nearly black when fully ripe, $\frac{1}{3}'$–$\frac{1}{2}'$ in length, about $\frac{1}{4}'$ in diameter; **seeds** light brown and lustrous.

A slender tree in Florida, occasionally 18°–20° high, with a straight trunk 4′ or 5′ in diameter, and slender light yellow-green or pale brown branchlets slightly pubescent during their first season; more often a shrub. Bark thin, close, yellowish brown.

Distribution. Florida, shores of Bay Biscayne to the Everglade Keys, Dade County, and on the southern keys; on the Bahama Islands and several of the Antilles, and in Colombia.

3. ALVARADOA Liebm.

Trees or shrubs, with bitter juices and slender terete pubescent branchlets. Leaves alternate, crowded at the end of the branches, unequally pinnate, long-petiolate, many-foliolulate, persistent; leaflets alternate, entire; stipules and stipels none. Flowers in many-flowered axillary or terminal racemes. Fruit a 2 or 3-winged samara, 3-celled below the middle, 2-celled above, crowned with remnants of the styles. Seed erect, compressed; testa membranaceous; albumen none; embryo oblong-compressed; cotyledons flat; radicle inferior, very short.

An anomalous genus, by several authors doubtfully referred to Sapindaceæ, but chiefly on account of its bitter properties now placed in Simaroubaceæ. It consists of three species; of these the widely distributed *Alvaradoa amorphoides* Liebmann, the type of the genus, occurs in southern Florida. The other species appear to be confined to the islands of Jamaica and Cuba.

1. Alvaradoa amorphoides Liebm.

Leaves 4′–12′ long, with 21–41 leaflets and slender petioles; leaflets oblong-obovate, obtuse or occasionally minutely mucronate at apex, gradually narrowed below into a short

Fig. 586

slender pubescent petiolule, slightly thickened and revolute on the margins, dark green above, pale pubescent below, $\frac{1}{2}'$–$\frac{3}{4}'$ long, about $\frac{1}{4}'$ wide, with a slender midrib and obscure primary veins. **Flowers** regular, minute, dioecious, on slender accrescent pubescent pedicels from the axils of ovate minute deciduous bracts, in many-flowered hoary-tomentose racemes 3′–4½′ long, the pistillate accrescent, becoming 4′–8′ in length; calyx campanulate, 5-parted, the lobes ovate, acute, hoary-tomentose on the outer surface; disk 5-lobed; staminate flowers appearing sessile in the bud; their pedicels only slightly accrescent; petals filiform; filaments slender, elongated, slightly villose toward the base, inserted between the lobes of the disk and alternate with the calyx-lobes; anthers introrse, 2-celled, united except at apex, opening longitudinally by marginal slits, their connective orbicular, conspicuous; pistillate flowers on short accrescent pedicels; petals 0 or very rarely present; stamens 0; ovary compressed, unequally 3-angled, villose-hirsute on the margins, 3-celled at base, with two small compressed empty cells, the third larger with two anatropous ovules; styles 2, subulate or recurved, often of unequal length, stigmatic above the middle. **Fruit** lanceolate, acuminate, narrowly 2-winged, ciliate on the margins with long spreading hairs, slightly tinged with red, $\frac{3}{4}'$ in length and about two-thirds as long as its slender hairy pedicel; **seeds** acute at ends, pale yellow, $\frac{1}{4}'$ long.

A slender tree, in Florida occasionally 30° high, with a trunk 6′–8′ in diameter, and slender branchlets hoary-pubescent during their first year becoming dull red-brown, glabrous and marked by numerous small pale lenticels and by the large obovate obcordate scars of fallen leaves showing the ends of three conspicuous equidistant fibro-vascular bundles; in Florida more often a shrub.

Distribution. Florida, Everglade Keys (Timbo Hummock near Gozman's Homestead, Caldwell's Hummock and Long Key), Dade County; in the Bahama Islands, and in Cuba, southern Mexico, Central America and Argentina.

XXVIII. BURSERACEÆ.

Trees or shrubs, with resinous bark and wood. Leaves alternate, pinnate, without stipules. Flowers perfect or polygamous, in clustered racemes or panicles; calyx 4–5-lobed, the lobes imbricated in the bud, persistent; petals 4–5, imbricated in the bud, distinct or slightly united, deciduous; stamens twice as many as the petals, inserted under the annular or cup-shaped disk; filaments distinct, subulate; anthers introrse, 2-celled, the cells opening longitudinally; pistil of 2–5 united carpels; ovary 2–5-celled; styles united; stigma 2–5-lobed; ovules 2 in each cell, pendulous, collateral, anatropous; micropyle superior; raphe ventral. Fruit drupaceous. Seeds without albumen; seed-coat membranaceous; embryo straight; cotyledons foliaceous; radicle short, superior.

Of the sixteen genera of this family, which is widely distributed through the tropics of the two hemispheres, one only, Bursera, occurs in the United States, reaching the shores of southern Florida with an arborescent species, and southern California and Arizona with another species.

1. BURSERA Jacq.

Trees, with balsamic resinous juices. Leaves unequally pinnate; leaflets opposite, petiolulate, entire or subserrate, thin, or coriaceous. Flowers polygamous, small, on fascicled or rarely solitary pedicels, in short or elongated lateral simple or branched panicles; calyx minute, membranaceous; petals inserted on the base of an annular crenate disk, reflexed at maturity above the middle; stamens inserted on the base of the disk; anthers oblong, attached on the back above the base, usually effete in the pistillate flower; ovary sessile, ovoid, 3-celled, rudimentary in the staminate flower; style short; stigma capitate, obtuse, 3-lobed; ovules suspended below the apex from the central angle. Fruit with a valvate epicarp, globose or oblong-oblique, indistinctly 3-angled; flesh coriaceo-carnose, 2–3-valved; nutlets 1–3, usually solitary, adnate to a persistent fleshy axis, 1-celled,

1-seeded, covered with a thin membranaceous coat. Seed ovoid, without albumen; seed-coat membranaceous; hilum ventral, below the apex; embryo straight; cotyledons contortuplicate.

Bursera with about forty species is confined to southern Florida, the Antilles, the southwestern United States and to Mexico, and Central and South America.

The generic name is in honor of Joachim Burser (1593–1649), a German botanist and physician.

CONSPECTUS OF THE ARBORESCENT SPECIES OF THE UNITED STATES.

Leaves 5–7 rarely 3-foliolate, their rachis and petiole without wings; staminate flowers in elongated many-flowered racemes. 1. **B. Simaruba** (D).

Leaves usually 10–22-foliolate, their rachis and petiole wing-margined; staminate flowers in short, usually 3-flowered clusters. 2. **B. microphylla** (G, H).

1. Bursera Simaruba Sarg. Gumbo Limbo. West Indian Birch.

Leaves confined to the end of the branchlets, 6′–8′ long, 4′–8′ wide, with a long slender petiole, and usually 5, rarely 3 or 7 leaflets coriaceous at maturity, oblong-ovate, oblique

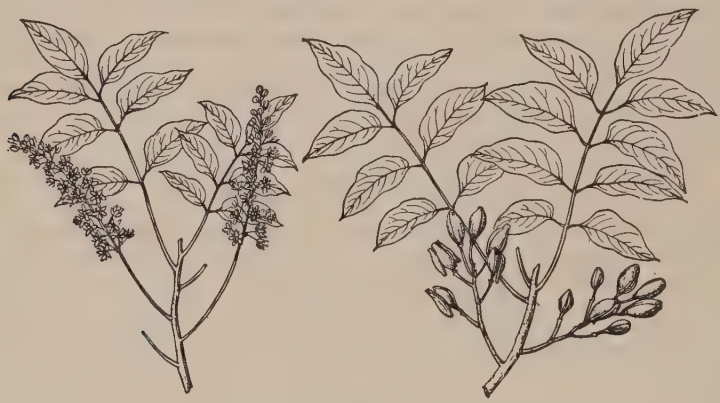

Fig. 587

at base, contracted at apex into a long or short point, $2\frac{1}{2}$′–3′ long, $1\frac{1}{2}$′–2′ broad, with stout petiolules often $\frac{1}{2}$′ long; deciduous in early winter or occasionally persistent until the following spring. **Flowers** about $\frac{3}{16}$′ in diameter, appearing before the leaves or as they unfold, on slender pedicels $\frac{1}{3}$′–$\frac{1}{2}$′ long, in slender raceme-like panicles, those of the staminate plant 4′–5′ long or nearly twice as long as those of the pistillate plant; calyx-lobes and petals 5; petals ovate-lanceolate, acute, revolute on the margins, and nearly four times as long as the slender acute calyx-lobes; stamens of the staminate flower as long as the petals and in the pistillate flower not more than half as long, with smaller often effete anthers. **Fruit** in short raceme-like clusters, $\frac{1}{4}$′–$\frac{1}{3}$′ long, 3-angled, with a thick dark red outer coat, separating readily into 3 broad-ovate valves, and containing 1 or rarely 2 bony triangular nutlets rounded at base, pointed at apex, and covered with a thin membranaceous light pink coat; **seeds** 1 or 2, triangular, rose color.

A glabrous tree, 50°–60° high, with a trunk $2\frac{1}{2}$°–3° in diameter, massive primary branches spreading nearly at right angles, and stout terete branchlets light gray during their first season, becoming during their second year reddish brown, covered with lenticular spots and conspicuously marked by large elevated obcordate yellow leaf-scars. **Winter-buds**

short, rounded, obtuse, with broad-ovate dark red scales slightly scarious on the margins. **Bark** of the trunk and large branches 1′ thick, glandular dotted, separating freely into thin papery bright red-brown scales exposing in falling the dark red-brown or gray inner bark. **Wood** spongy, very light, exceedingly soft and weak, light brown, with thick sapwood, soon becoming discolored by decay. Pieces of the trunk and large branches set in the ground soon produce roots and grow rapidly into large trees. The aromatic resin obtained by incisions cut in the trunk was formerly used in the treatment of gout, and in the West Indies is manufactured into varnish. An infusion of the leaves is sometimes used in Florida as a substitute for tea.

Distribution. Florida, from Cape Canaveral to the southern keys, and on the west coast from Terra Ceia Island, Manatee County, Placida, Charlotte County, and Gasparilla Island southward; one of the largest and most common of the south Florida trees, and the only one which sheds its foliage during the autumn and winter; on most of the West Indian islands, in tropical Mexico, Guatemala, New Granada, and Venezuela.

2. Bursera microphylla A. Gray.

Leaves glabrous, deciduous, 1′–1¼′ long, with a slender narrowly winged rachis and petiole and usually 10–20 oblong or oblong-obovate leaflets rounded at apex, obliquely cuneate at base, sessile, about ¼′ long and ⅛′ wide. **Flowers** appearing in June before

Fig. 588

the leaves, ⅛′ long on slender pedicels from the axils of minute acuminate caducous bracts, in mostly 3-flowered clusters ¼′ in length; staminate, calyx-lobes ovate, acute; petals 5, lanceolate, acuminate, revolute on the margins, 3 or 4 times longer than the calyx-lobes, white; stamens shorter than the petals; pistillate flower not seen. **Fruit** ripening in October, ellipsoid or slightly obovoid, solitary, drooping on the thickened pedicel ⅕′ in length, 3-angled, ¼′ long, red, glabrous, splitting into three valves; nutlets usually ovoid, acute, narrow at base, thin walled, 3-angled, gray with a deep depression at base.

A tree, rarely 10°–12° high, with a short trunk 2½′–3′ in diameter, stout erect and spreading branches, forming a wide round-topped head, and slender glabrous red branchlets, roughened during their first year by the crowded scars of fallen leaves; more often a low shrub. **Bark** of the trunk pale yellow, separating into membranaceous scales, the outer layer thin and firm, the inner layer corky, reddish brown, ½′ thick. **Wood** hard, close-grained, pale yellow.

Distribution. Colorado Desert, between Fish Creek and Carriso Creek about twenty-five miles from the Mexican Boundary, on "banks of dry washes, in hard sterile soil covered with boulders" (*E. H. Davis*), Imperial County, California; near Maricopa, Pinal County, Arizona, and in Lower California and Sonora; reported as a tree only from California.

XXIX. MELIACEÆ.

Trees or shrubs, with hard wood and alternate pinnate leaves, without stipules. Flowers in panicles, perfect, regular; calyx 5-lobed, the lobes contorted (in *Swietenia*) in the bud, persistent; petals 5, convolute in the bud; stamens inserted at the base of the disk; filaments united into a tube; anthers introrse, 2-celled, the cells opening longitudinally; ovary 3–5-celled, free, surrounded at base by an annular or cup-shaped disk; styles united, dilated into a 5-lobed stigma; ovules numerous in each cell, suspended, semi-anatropous; raphe ventral; micropyle superior. Fruit a capsule (in *Swietenia*) or drupe. Seeds often winged; embryo with leafy cotyledons.

A family with about forty genera chiefly confined to the tropics, with a single representative, Swietenia, in southern Florida. *Melia Azedarach* L., of this family, the China-tree or Pride of India, with drupaceous fruits, has long been cultivated in the southern states, where it now often grows spontaneously.

1. SWIETENIA Jacq.

Trees, with heavy dark red wood. Leaves abruptly pinnate, glabrous, long-petiolate, persistent; leaflets opposite, petiolulate, usually oblique at base. Flowers small, in axillary or subterminal panicles produced near the end of the branches; calyx minute; petals spreading; staminal tube urn-shaped, connate with the petals, 10-lobed, the lobes convolute in the bud; anthers 10, fixed by the back below the sinuses of the staminal tube, included; ovary ovoid, 5-celled, the cells opposite the petals; style erect, longer than the tube of the stamens; stigma discoid, 5-rayed. Fruit a 5-celled 5-valved capsule septicidally dehiscent from the base, the valves separating from a persistent 5-angled axis thickened toward the apex and 5-winged toward the base. Seeds suspended from near the summit of the axis, imbricated in 2 ranks, compressed, emarginate, produced above into a long membranaceous wing with the hilum at its apex and transversed by the raphe; embryo transverse; cotyledons conferruminate with each other and with the thin fleshy albumen; radicle short, papillæform.

Swietenia with five species is confined to tropical America from southern Florida where one species occurs, to Venezuela, western and southwestern Mexico, and the east coast of Central America.

The generic name is in honor of Baron von Swieten (1700–1772), the distinguished Dutch physician, founder of the Botanic Garden and of the Medical School at Vienna.

1. Swietenia mahagoni Jacq. Mahogany.

Leaves 4′–6′ long, with a slender glabrous petiole thickened at base and 3 or 4 pairs of ovate-lanceolate leaflets rounded at base on the upper side, narrow-cuneate or nearly straight on the lower side, entire, coriaceous, pale yellow-green or slightly rufous on the under surface, 3′–4′ long, 1′–1½′ wide, with a prominent reddish brown midrib, conspicuous reticulate veins, and a stout grooved petiolule ¼′ long. **Flowers** appearing in July and August on slender puberulous pedicels, bibracteolate near the middle, 1 or 2 together at the end of the branches of slender panicles in the axils of leaves of the year; calyx glabrous, cup-shaped, much shorter than the ovate elliptic petals ⅛′ long and slightly emarginate at apex. **Fruit** ripening in the autumn or early winter, long-stalked, ovoid, rounded at apex narrowed at base, 4′–5′ long and 2½′ broad, with thick dark brown valves rugose and pitted on the surface, its axis obovoid 3′ or 4′ long, 1′–1½′ thick, dark red-brown,

marked near the apex by the dark scars left by the falling seeds; **seeds** $\frac{3}{4}'$ long, almost square, thickened at base and nearly one fourth as long as their ovate rugose red-brown wings rounded or truncate at apex and gradually contracted below.

A tree, in Florida rarely more than 40°–50° high or with a trunk exceeding 2° in diameter, and slender glabrous angled branchlets covered during their first season with pale red-brown bark, becoming lighter or gray faintly tinged with red and thickly covered with lenticels during their second year; much larger in the West Indies. **Winter-buds** about $\frac{1}{8}'$ long, with broad-ovate minutely apiculate loosely imbricated light red scales. **Bark** of the trunk in Florida $\frac{1}{2}'$–$\frac{2}{3}'$ thick, with a dark red-brown surface broken into short broad rather thick scales. **Wood** heavy, exceedingly hard and strong, close-grained, very

Fig. 589

durable, rich red-brown, becoming darker with age and exposure, with thin yellow sapwood of about 20 layers of annual growth: the most esteemed of all woods for cabinet-making, and also largely used in the interior finish of houses and railroad cars, and formerly in ship and boatbuilding. The bark is bitter and astringent and has been used as a substitute for quinine in the treatment of intermittent fevers.

Distribution. Florida, hummocks, shores of Bay Biscayne on the Everglade Keys and near Flamingo on White Water Bay, Dade County, on Elliotts Key, Key Largo and Upper Matacombe Key; rare and now nearly exterminated except in the region of Cape Sable; on the Bahama and many of the West Indian islands.

XXX. EUPHORBIACEÆ.

Trees, shrubs, or herbs, with acrid juice, and alternate stipular leaves. Flowers monœcious or dicœcious; calyx 3–6-lobed or parted, the divisions imbricated in the bud, or wanting; corolla 0; stamens 2 or 3, or as many or twice as many as the calyx-lobes; anthers 2-celled, opening longitudinally; ovules 1 or 2 in each cell, suspended, anatropous; raphe ventral; micropyle superior. Fruit a drupe or capsule. Seeds albuminous; cotyledons flat, much longer than the superior radicle.

The Euphorbia family, widely distributed over tropical and temperate regions, with some one hundred and thirty genera and over three thousand species, is represented in the United States by three arborescent genera, with only five species, and by many shrubby herbaceous and annual plants.

CONSPECTUS OF THE ARBORESCENT GENERA OF THE UNITED STATES.

Fruit drupaceous.
Nutlets usually 1-celled and 1-seeded; stamens as many or twice as many as the calyx-lobes, free. **1. Drypetes.**
Nutlets 6–8-celled and 6–8-seeded; stamens 2 or 3, united into a column. **2. Hippomane.**
Fruit a 3-lobed capsule splitting into three 2-valved 1-seeded carpels. **3. Gymnanthes.**

1. DRYPETES Vahl.

Trees or shrubs, with thick juice, and terete branchlets. Leaves involute in the bud, petiolate, penniveined, coriaceous, persistent; stipules minute, caducous. Flowers axillary, sessile or pedicellate, their pedicels from the axils of minute deciduous bracts, ebracteolate, the males in many-flowered clusters, the females solitary or in few-flowered clusters; calyx divided nearly to the base into 4 or 5 lobes rounded or acute at apex, deciduous or persistent under the fruit; stamens inserted under the margin of a flat or concave slightly lobed disk, 0 in the pistillate flower; filaments filiform; anthers ovoid, emarginate, attached on the back near the base, extrorse or introrse, 2-celled, the cells affixed to a broad oblong connective; ovary sessile, ovoid, 1 or rarely 2-celled, with 1 or 2 sessile or subsessile peltate or reniform stigmas, rudimentary or wanting in the staminate flower; ovules collateral, descending, attached to the central angle of the cell, operculate, with a hood-like body developed from the placenta. Fruit drupaceous, ovoid or subglobose, tipped with the withered remnants of the stigmas; flesh thick and corky or thin and crustaceous; stone thick or thin, bony or crustaceous, 1-celled and 1-seeded, or rarely 2-celled and 2-seeded. Seed filling the cavity of the nut; seed-coat crustaceous or membranaceous; embryo erect in thin fleshy albumen.

Drypetes is confined to the tropical regions of the New World, and is distributed from southern Florida through the West Indies to eastern Brazil. Of the eleven species now distinguished, two inhabit the coast-region of southern Florida.

The generic name, from δρύπτα, relates to the character of the fruit.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Calyx 5-lobed; stamens 8; ovary 1-celled; fruit oblong, ivory-white; outer coat thick and mealy; stone thick-walled. **1. D. diversifolia** (D).
Calyx 4-lobed; stamens 4; ovary 2-celled; fruit subglobose, bright red; outer coat thin, crustaceous; stone thin-walled. **2. D. lateriflora** (D).

1. Drypetes diversifolia Krug & Urb. White Wood.

Drypetes keyensis Krug & Urb.

Leaves appearing in early spring and falling during their second year, entire, oval or oblong, often more or less falcate, acute, acuminate, rounded or rarely emarginate at apex, rounded or cuneate at base, on young plants often spinose-dentate, when they unfold thin and membranaceous, light green or green tinged with red and pilose with scattered pale hairs, and at maturity coriaceous, dark green and lustrous, rather paler on the lower surface than on the upper surface, 3′–5′ long and 1′–2′ wide, with a broad thick pale midrib raised and rounded on the upper side and obscure primary veins arcuate and united near the thick revolute cartilaginous margins and connected by conspicuous coarsely reticulated veinlets; petioles stout, yellow, grooved above, ½′ long; stipules nearly triangular, rather less than $\frac{1}{10}$′ long, caducous. **Flowers** on pedicels rather shorter than the petioles, opening in early spring from the axils of leaves of the previous year, the staminate in many-flowered clusters, the pistillate usually solitary or occasionally in 2–3-flowered clusters; calyx

yellow-green, hirsute on the outer surface, $\frac{1}{16}'$ long, and divided nearly to the base into 5 ovate acute boat-shaped lobes deciduous from the fruit; stamens about 8, inserted on the borders of the slightly lobed pulvinate concave disk; filaments unequal in length, rather longer than the calyx-lobes and a little longer than the broad-ovoid emarginate pilose extrorse anthers, with broad ovate acute connectives; ovary sessile, hirsute, 1-celled, crowned with a broad sessile slightly stalked oblique pulvinate stigma, wanting in the staminate flower. **Fruit** ripening in the autumn, deciduous at maturity from its stout erect stalk much enlarged at apex and $\frac{1}{3}'$ long, ovoid, 1′ long, ivory-white, with thick dry

Fig. 590

mealy flesh closely investing the light brown stone narrowed at base into a long point, with bony walls $\frac{1}{8}'$ thick and penetrated longitudinally by large fibro-vascular bundle-channels; **seed** oblong, rounded at the ends, nearly $\frac{1}{2}'$ long, covered with a thin membranaceous light brown coat marked by conspicuous veins radiating from the small hilum.

A tree, occasionally 30°–40° high, with a trunk sometimes a foot in diameter, stout usually erect branches forming an oblong round-topped head, and stout branchlets light green tinged with red and covered with pale scattered caducous hairs when they first appear, becoming ashy gray and roughened by numerous elevated circular pale lenticels and later by the large prominent orbicular leaf-scars displaying the ends of 3 conspicuous fibro-vascular bundles. **Winter-buds** minute, obtuse, partly immersed in the bark and coated with brown resin. **Bark** of the trunk about $\frac{1}{2}'$ thick, smooth, milky white and often marked by large irregular gray or pale brown patches. **Wood** heavy, hard, not strong, brittle, close-grained, and brown streaked with bright yellow, with thick yellow-brown sapwood.

Distribution. Florida, Flamingo near Cape Sable (*C. T. Simpson*), Cocoanut Grove (*Miss O. Rodham*), Dade County, on Key West, Key Largo, Elliotts, Lower Metacombe and Umbrella Keys. One of the rarest of the tropical trees of Florida; on the Bahamas.

2. Drypetes lateriflora Urb. Guiana Plum.

Leaves appearing in Florida in early spring and falling during their second year, oblong, acute or acuminate at apex, gradually narrowed at base, and entire, when they unfold thin and covered with scattered pale hairs, and at maturity subcoriaceous, dark green and lustrous, 3′–4′ long and $\frac{1}{2}'$–$1\frac{1}{2}'$ wide, with a conspicuous light-colored midrib, rounded above, and pale obscure primary veins arcuate and united near the slightly thickened revolute margins and connected by slender reticulate veinlets; petioles slender, grooved, $\frac{1}{4}'$ in length. **Flowers** on pedicels shorter than the petioles, opening late in the autumn or in early winter on branches one or two years old, in the axils of leaves or from leafless nodes, in

many or few-flowered clusters; calyx greenish white, hirsute on the outer surface, divided to the base into 4 ovate rounded lobes, persistent under the fruit; stamens 4, inserted under the margin and between the lobes of the flat tomentose disk; filaments slender, exserted; anthers introrse, emarginate, pilose, wanting in the pistillate flower; ovary ovoid, tomentose, 2-celled, with 2 nearly sessile oblique spreading cushion-like stigmas. **Fruit** ripening during the spring and early summer, subglobose, $\frac{1}{3}'$ in diameter, tipped with the conspicuous blackened remnants of the stigmas, bright red, covered with soft pubescence, solitary or in clusters of 2 or 3, deciduous at maturity from its stout stalk enlarged at apex and $\frac{1}{4}'$

Fig. 591

long; flesh thin and crustaceous, closely investing the thin-walled crustaceous stone; **seed** usually solitary by abortion, obovoid, gibbous, $\frac{1}{8}'$ long, narrowed below, narrowed and marked at apex by the elevated pale hilum and on the inner surface of the seed-coat by the broad conspicuous raphe.

A tree, 20°–30° high, with a short trunk 5′–6′ in diameter, small erect branches, and slender branchlets, light green tinged with red when they first appear, becoming in their first winter ashy gray and marked by scattered pale lenticels, and at the end of their second year by the small elevated oval leaf-scars displaying the ends of 3 fibro-vascular bundles. **Winter-buds** minute, acute or obtuse, chestnut-brown, and covered with pale hairs. **Bark** of the trunk about $\frac{1}{16}'$ thick, light brown tinged with red, the generally smooth surface separating into small irregular scales. **Wood** heavy, hard, brittle, close-grained, rich dark brown, with thick yellow sapwood.

Distribution. Florida, Palm Beach, Palm Beach County, shores of Bay Biscayne, Dade County, and on many of the southern keys; common on the Bahama Islands and on several of the Antilles.

2. HIPPOMANE L.

A glabrous tree, with thick acrid juice, scaly bark, and stout pithy branchlets marked by circular raised lenticels, and oblong or semiorbicular horizontal elevated leaf-scars displaying a row of obscure fibro-vascular bundle-scars, and nearly encircled at the nodes by ring-like scars left by the falling of the stipules. Winter-buds ovoid, acute, covered by many loosely imbricated long-pointed chestnut-brown scales. Leaves alternate, involute in the bud, tardily deciduous, broad-ovate, rounded and abruptly narrowed at apex into a broad point terminating in a slender mucro, rounded or subcordate at base, remotely crenulate-serrate with minute gland-tipped teeth, penniveined, long-petiolate, at first pilose with occasional long pale hairs, soon becoming glabrous, and at maturity thick and coriaceous, dark yellow-green and lustrous above, paler and dull below, with a stout light yellow midrib

raised and rounded on the upper side, and slender primary veins remote, arcuate, and united at some distance from the margins and connected by conspicuous coarsely reticulate veinlets more prominent on the upper than on the lower side; their petioles elongated, slender, rigid, light yellow, rounded below, obscurely grooved above, marked at the apex by large orbicular dark red glands; stipules ovate-lanceolate, abruptly narrowed from a broad base, slightly laciniate near the apex, membranaceous, light chestnut-brown, caducous. Inflorescence terminal, spicate, appearing in early spring usually before the unfolding leaves, the stout fleshy rachis often bearing at the base acute sterile deciduous bracts, or 1 or 2 small leaves, the minute pistillate flowers solitary in their axils or in the axils of ovate acute lanceolate bracts furnished with 2 lateral glandular bractlets; staminate flowers minute, articulate on slender pedicels clustered in 8–15-flowered fascicles in the axils of simple bracts higher on the rachis and extending to its apex; calyx usually 3-lobed, the lobes imbricated in the bud, that of the staminate flower yellow-green, membranaceous, divided below into 3 or sometimes into 2 acute lobes; calyx of the pistillate flower, ovoid, yellow-green, divided nearly to the base into 3 ovate acute concave divisions rounded on the back; stamens 2 or often 3, exserted, more or less connate by their filaments into a stout column, free and spreading at apex; anthers ovoid, light yellow, surmounted by the short prolonged connective, attached on the back below the middle, erect, extrorse; ovary 6–8-celled, narrowed at base, gradually contracted above into a short simple cylindric style separating into 6–8 long radiating flattened abruptly reflexed lobes stigmatic on the inner face; ovule solitary in each cell. Fruit drupaceous, pome-shaped, obscurely 6–8-lobed, raised on a thickened woody stem; skin thin, light yellow-green or yellow and red; flesh thick, lactescent, adherent to the thick-walled rugose deeply winged 6–8-celled, 6–8-seeded subglobose stone flattened at the ends, the cells divided throughout by thin dark radial plates, ultimately separable, penetrated near the summit by oblique canals filled by the funicles of the seeds. Seeds oblong-ovoid, marked by a minute slightly elevated hilum and on the ventral face by an obscure raphe; seed-coat membranaceous, separable into 2 layers, the outer dark, the inner thinner, light brown; embryo surrounded by thick fleshy albumen.

The genus is represented by a single species abounding in exceedingly poisonous caustic sap which produces cutaneous eruptions and when taken internally destroys the mucous membrane; formerly employed by the Caribs to poison arrows.

The generic name is from ἵππος and μανία, and was first used by the Greeks to distinguish some plant with properties excitant to horses.

1. Hippomane Mancinella L. Manchineel.

Leaves 3′–4′ long, $1\frac{1}{2}$′–2′ wide, unfolding in early spring and persistent in Florida until the spring of the following year; petioles $2\frac{1}{2}$′–4′ in length. **Flowers** opening in March

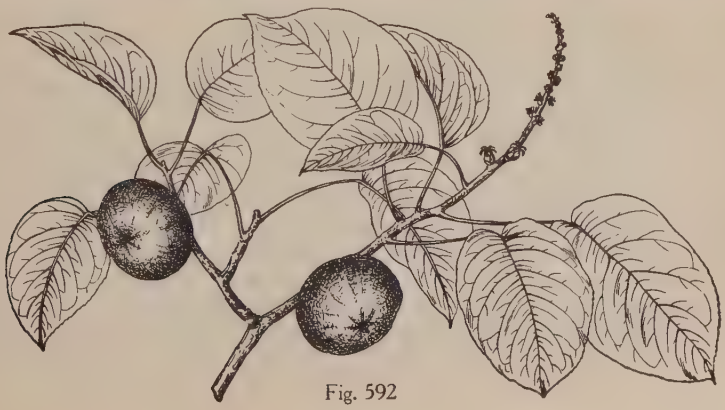

Fig. 592

before the leaves of the year; rachis of the inflorescence 4′–6′ long, dark purple, more or less covered with a glaucous bloom. **Fruit** ripening in the autumn or early winter and often persistent on the branches until after the appearance of the flowers of the following year, 1′–1½′ in diameter, light yellow-green, with a bright red cheek; seeds about ¼′ long.

A tree, in Florida rarely more than 12°–15° high, with a short trunk 5′–6′ in diameter, long spreading pendulous branches forming a handsome round-topped head; in the West Indies often 50°–60° tall, with a trunk occasionally 3° in diameter. **Bark** of the trunk ¼′–½′ thick, dark brown and broken on the surface into small thick appressed irregularly shaped scales; in the West Indies sometimes smooth, light gray or nearly white. **Wood** light and soft, close-grained, dark brown, with thick light brown or yellow sapwood.

Distribution. Florida, sandy beaches and dry knolls in the immediate neighborhood of the ocean, shores of White Water Bay and on many of the southern keys; on the Bahama Islands, through the Antilles to the northern countries of South America, and to southern Mexico and the eastern and western coasts of Central America.

3. GYMNANTHES Sw.

Glabrous trees or shrubs, with milky juice and slender terete branchlets. Leaves conduplicate in the bud, petiolate, entire or crenulate-serrate, coriaceous, penniveined, persistent; stipules membranaceous, minute, caducous. Flowers monœcious or rarely dicœcious; inflorescence buds covered with closely imbricated chestnut-brown scales, lengthening in anthesis, bearing in the upper axils numerous 3-branched clusters of staminate flowers, their branches furnished with minute ovate bracts, and in the lower axils 2 or 3 long-stalked pistillate flowers; calyx of the staminate flower minute or 0; stamens 2 or rarely 3; filaments filiform, inserted on the slightly enlarged torus, free or slightly connate at base; anthers attached on the back below the middle, erect, ovoid, 2-celled, the cells parallel; calyx of the pistillate flower reduced to 3 bract-like scales; ovary ovoid, 3-celled, narrowed into 3 recurved styles free or slightly united at base, stigmatic on their inner face; ovule solitary in each cell. Fruit a 3-lobed capsule separating from the persistent axis into three 2-valved 1-seeded carpels dehiscent on the dorsal suture and partly dehiscent on the ventral suture. Seed ovoid or subglobose, strophiolate; seed-coat crustaceous; embryo erect in fleshy albumen.

Gymnanthes with about ten species is confined to the tropics of the New World and is distributed from southern Florida, where one species occurs, through the West Indies to Mexico and Brazil.

The generic name, from γυμνός and ἄνθος, relates to the structure of the naked flowers.

1. Gymnanthes lucida Sw. Crab Wood.

Leaves oblong-ovate or ovate-lanceolate, obscurely and remotely crenulate-serrate or often entire, when they unfold thin and membranaceous, deeply tinged with red, and glandular on the teeth with minute caducous dark glands, and at maturity coriaceous, dark green and lustrous on the upper surface and pale and dull on the lower surface, 2′–3′ long, ⅔′–1½′ wide, with a broad pale midrib raised and rounded on the upper side, obscure primary veins arcuate and united near the margins and connected by prominent coarsely reticulate veinlets; appearing in Florida in early spring and remaining on the branches through their second summer; petioles broad, slightly grooved, about ¼′ in length; stipules ovate, acute, light brown, clothed on the margins with long pale hairs, about $\frac{1}{10}$′ long. **Flowers:** inflorescence buds appearing in Florida late in the autumn in the axils of leaves of the year and beginning to lengthen in spring, the inflorescence becoming 1½′–2′ long, with a slender glabrous angled rachis, the scales broad-ovate, pointed, concave, rounded and thickened at apex, puberulous and ciliate on the margins, those inclosing the male flowers connate with the flowers and persistent under the calyx, those subtending the female flowers at the base of the inflorescence and not raised on their peduncle. **Fruit** produced in Florida sparingly, ripening in the autumn, slightly obovoid, dark reddish brown

or nearly black, $\frac{1}{3}'$ in diameter, covered with thin dry flesh, and pendent on a slender stem 1′ or more in length; seeds ovoid.

A tree, occasionally 20°–30° high, with a trunk 6′–8′ in diameter and often irregularly ridged, the rounded ridges spreading near the surface of the ground into broad buttresses, slender erect branches forming a narrow open oblong head, and slender upright branchlets light green more or less deeply shaded with red when they first appear, becoming in their first winter light gray-brown faintly tinged with red and roughened by numerous oblong pale lenticels, ultimately ashy gray and marked at the end of their second year by the

Fig. 593

semiorbicular elevated leaf-scars displaying the ends of 4 fibro-vascular bundle-scars superposed in pairs. Winter-buds ovoid, obtuse, covered with chestnut-brown scales, about $\frac{1}{15}'$ long. Bark of the trunk dark red-brown, about $\frac{1}{16}'$ thick, separating into large thin scales, in falling displaying the light brown inner bark. Wood very heavy, hard, close-grained, rich dark brown streaked with yellow, with thick bright yellow sapwood; in Florida occasionally manufactured into canes, and used as fuel.

Distribution. Florida, common in low woods from the shores of Bay Biscayne to the Everglade Keys, Dade County, and on many of the southern keys to those of the Marquesas group; on the Bahama Islands, and on many of the Antilles.

XXXI. ANACARDIACEÆ.

Trees or shrubs, with terete pithy branchlets, resinous juice, and alternate simple or pinnate leaves, without stipules, and scaly or naked buds. Flowers regular, minute, diœcious, polygamo-diœcious, or polygamo-monœcious; calyx-lobes and petals 5, imbricated in the bud or 0; stamens as many as the petals and alternate and inserted with them on the margin or under an hypogynous annular fleshy slightly 5-lobed disk; filaments filiform; anthers oblong, introrse, 2-celled, the cells opening longitudinally; ovary 1-celled; styles 1–3; ovule solitary, suspended from the apex of a slender funicle rising from the base of the cell, anatropous; micropyle superior; styles 3, united or spreading; stigmas terminal. Fruit drupaceous. Seed without albumen; seed-coat thin and membranaceous; embryo filling the cavity of the seed; cotyledons flat, accumbent on the short radicle.

The Sumach family with some sixty genera is mostly confined to the warmer parts of the earth's surface and contains the Mango, Pistacia, and other important trees. In the flora of the United States four genera have arborescent representatives.

CONSPECTUS OF THE ARBORESCENT GENERA OF THE UNITED STATES.

Flowers without petals, and in the species of the United States, without a calyx. 1. **Pistacia.**
Flowers with a calyx and petals.
Flowers usually dicœcious by abortion; styles lateral, spreading; pedicels of the abortive flowers becoming long and plumose at maturity; fruit compressed, very oblique; leaves simple, deciduous. 2. **Cotinus.**
Flowers mostly dicœcious; styles terminal, short, united; stigma 3-lobed; fruit ovoid, glabrous; leaves unequally pinnate, persistent. 3. **Metopium.**
Flowers polygamo-dicœcious or polygamo-monœcious; styles terminal, spreading; fruit usually globose, naked or clothed with acrid hairs; leaves unequally pinnate, trifoliolate or rarely simple, deciduous or rarely persistent. 4. **Rhus.**

1. PISTACIA L.

Balsamic trees or shrubs. Leaves 3-foliolate or equally or unequally pinnate, petiolate, deciduous or persistent. Flowers small, dicœcious, subtended by a bract and 2 branchlets, short pedicellate in panicles or racemes; calyx 1 or 2-lobed or in the pistillate flower 3–5-lobed, or 0; petals 0, stamens 3–5, 0 in the pistillate flower; filaments short, their base connate with the disk; anthers large; ovary subglobose or short-ovoid, rudimentary or 0 in the staminate flower; style 3-lobed, shorter than the 3 obovate-oblong or oblong stigmas. Drupe ovoid, oblique, compressed; exocarpa thin; the stone bony, 1-seeded; seed compressed; cotyledons thick plano-convex.

Pistacia with eight or nine species is confined to the valley of the lower Rio Grande, southern Mexico; the Canary Islands, the countries adjacent to the Mediterranean, and northern and central China, with one species growing on the northern banks of the Rio Grande in Texas.

The Pistacio-nuts of commerce, the green or yellow seeds of *P. vera* L. are largely used in confectionery, and some of the species are valued for the decoration of parks and gardens.

Pistacia from πιστ and ἀκεομαι, in reference to the healing properties of its resinous exudations.

1. Pistacia texana Swing.

Leaves persistent or tardily deciduous, 9–19-foliolate, with a slightly winged rachis pubescent above and a flattened narrow-winged petiole $\frac{1}{2}'$–$\frac{3}{4}'$ in length; leaflets spatulate,

Fig. 594

rounded and often mucronate at apex, gradually narrowed below into a deltoid or subcuneiform base, entire, more or less curved and unequilateral, wine-red when they unfold, and at maturity thin, dark green and sparingly pubescent along the midrib above, pale and glabrous below, nearly sessile or the terminal leaflet raised on a short petiolule, $\frac{5}{12}'$–$\frac{3}{4}'$ long and about $\frac{1}{4}'$ wide, with a slender midrib often near one side of the leaflet and reticulate veinlets. **Flowers** small, without a calyx, appearing just before or with the new leaves, in simple nearly glabrous panicles, their bracts and bractlets ciliate on the margins and wine-red at apex; staminate flowers more crowded than the pistillate, in compact panicles $\frac{3}{4}'$–$1\frac{1}{2}'$ long; anthers reddish yellow or wine color; pistillate flowers in loose panicles $1\frac{1}{2}'$–$2\frac{1}{2}'$ in length; ovary ovoid or subglobose, two of the three styles with 2-lobed stigmas, the third with a 3-lobed stigma. **Fruit** oval, dark reddish brown and slightly glaucescent, about $\frac{1}{4}'$ long and $\frac{1}{6}'$ broad, usually striate.

A small tree, occasionally 30° high with a short trunk 15′–18′ in diameter, with stout erect and spreading branches forming a head sometimes 30°–35° across, and slender slightly pubescent reddish branchlets becoming grayish brown by the end of their first year; more often a large shrub with numerous stout stems.

Distribution. Texas, limestone cliffs and the rocky bottoms of cañons periodically swept by floods, and in deep narrow ravines, along the lower Pecos River and in the neighborhood of its mouth, Valverde County; and in northeastern Mexico.

2. COTINUS L.

Small trees or shrubs, with scaly bark, small acute winter-buds, with numerous imbricated scales, fleshy roots, and strong-smelling juice. Leaves simple, petiolate, oval, obovate-oblong or nearly orbicular, glabrous or more or less pilose-pubescent, deciduous. Flowers regular, dicœcious by abortion or rarely polygamo-dicœcious, greenish yellow, on slender pedicels accrescent after the flowering period, mostly abortive and then becoming conspicuously tomentose-villose at maturity, in ample loose terminal or lateral pyramidal or thyrsoidal panicles, the branches from the axils of linear acute or spatulate deciduous bracts; calyx-lobes ovate-lanceolate, obtuse, persistent; disk coherent with the base of the calyx and surrounding the base of the ovary; petals oblong, acute, twice as long as the calyx, inserted under the free margin of the disk opposite its lobes, deciduous; stamens shorter than the petals, usually rudimentary or wanting in the pistillate flower; ovary sessile, obovoid, compressed, rudimentary in the staminate flower; styles 3, short and spreading from the lateral apex of the ovary; stigmas large, obtuse. Fruit oblong-oblique, compressed, glabrous, conspicuously reticulate-veined, light red-brown, bearing on the side near the middle the remnants of the persistent styles, the outer coat thin and dry; stone thick and bony.

Cotinus is widely distributed through southern Europe and the Himalayas to central China with a single species, and is represented in the southern United States by one species.

The Old World *Cotinus coggygria* Scop., the Smoke-tree of gardens, is often cultivated in the United States.

The generic name is from Κότινος, the classical name of a tree with red wood.

1. Cotinus americanus Nutt. Chittam Wood.

Leaves oval or obovate, rounded or sometimes slightly emarginate at apex, gradually contracted at base, and entire, with slightly wavy revolute margins, when they unfold light purple and covered below with fine silky white hairs, and at maturity dark green on the upper surface, pale on the lower surface, and puberulous along the under side of the broad midrib and primary veins, 4′–6′ long and 2′–3′ wide; turning in the autumn brilliant shades of orange and scarlet; petioles stout, $\frac{1}{2}'$–$\frac{3}{4}'$ in length. **Flowers** appearing late in April or early in May on pedicels $\frac{1}{2}'$–$\frac{3}{4}'$ long, and usually collected 3 or 4 together in loose umbels near the end of the principal branches of puberulous terminal slender long-branched

few-flowered panicles 5′–6′ long and 2½′–3′ broad, the staminate and pistillate flowers on different individuals. **Fruit** produced very sparingly, about ⅛′ long, on stems 2′–3′ in length; the sterile pedicels becoming 1½′–2′ long at maturity and covered with short not very abundant rather inconspicuous pale purple or brown hairs; **seed** kidney-shaped, pale brown, about $\frac{1}{16}$′ long.

A tree, 25°–35° high, with a straight trunk occasionally 12′–14′ in diameter, usually dividing 12°–14° from the ground into several erect stems separating into wide-spreading often slightly pendulous branches, and slender branchlets purple when they first appear, soon becoming green, bright red-brown and covered with small white lenticels and marked by large prominent leaf-scars during their first winter, and dark orange-colored in their second year. **Winter-buds** ⅛′ long, and covered with thin dark red-brown scales. **Bark** of the trunk ⅛′ thick, light gray, furrowed, and broken on the surface into thin oblong scales.

Fig. 595

Wood light, soft, rather coarse-grained, bright clear rich orange color, with thin nearly white sapwood; largely used locally for fence-posts and very durable in contact with the soil; yielding a clear orange-colored dye.

Distribution. Banks of the Ohio River, Owensboro, Daviess County, Kentucky (*E. J. Palmer*); near Huntsville, Madison County, Alabama; valley of White River in Stone and Taney Counties, southern Missouri; near Cotter, Baxter County, and Van Buren, Crawford County, Arkansas, and eastern Oklahoma; valleys of the upper Guadalupe and Medina Rivers, western Texas; usually only in small isolated groves or thickets scattered along the sides of rocky ravines or dry slopes; very abundant as a small shrub and spreading over many thousand acres of the mountain cañons, and high hillsides in the neighborhood of Spanish Pass, Kendall County, Texas.

Occasionally cultivated in the eastern United States and rarely in Europe: hardy as far north as eastern Massachusetts.

3. METOPIUM P. Br.

Trees or shrubs, with naked buds, fleshy roots, and milky exceedingly caustic juice. Leaves unequally pinnate, persistent; leaflets coriaceous, lustrous, long-petiolulate. Flowers dicœcious, yellow-green, on short stout pedicels, in narrow erect axillary clusters at the ends of the branches, with minute acute deciduous bracts and bractlets, the males and females on different trees; calyx-lobes semiorbicular, about half as long as the ovate obtuse petals; stamens 5, inserted under the margin of the disk; filaments shorter than the anthers, minute and rudimentary in the pistillate flower; ovary ovoid, sessile, minute in the stami-

nate flower; style terminal, short, undivided; stigma 3-lobed. Fruit ovoid, compressed, smooth and glabrous, crowned with the remnants of the style; outer coat thick and resinous; stone crustaceous. Seed nearly quadrangular, compressed; seed-coat smooth, dark brown and opaque, the broad funicle covering its margin.

Metopium with two species is confined to southern Florida and the West Indies.

The generic name, from ὄπος, was the classical name of an African tree now unknown.

1. Metopium toxiferum Kr. & Urb. Poison Wood. Hog Gum.

Metopium Metopium Small.

Leaves clustered near the end of the branches, 9′–10′ long, with stout petioles swollen and enlarged at base, and 5–7 leaflets, or often 3-foliolate; unfolding in March and persistent until the following spring; leaflets ovate, rounded or usually contracted toward

Fig. 596

the acute or sometimes slightly emarginate apex, rounded or sometimes cordate or cuneate at base, 3′–4′ long, 2′–3′ broad, with thickened slightly revolute margins, a prominent midrib, primary veins spreading at right angles, and numerous reticulate veinlets; petiolules stout, $\frac{1}{2}$′–1′ long, that of the terminal leaflet often twice as long as the others. **Flowers** about $\frac{1}{8}$′ in diameter, in clusters as long or rather longer than the leaves; petals yellow-green, marked on the inner surface by dark longitudinal lines; stamens rather shorter than the petals. **Fruit** ripening in November and December, pendent in long graceful clusters, orange-colored, rather lustrous, $\frac{3}{4}$′ in length; **seed** about $\frac{1}{4}$′ long.

A tree, frequently 35°–40° high, with a short trunk sometimes 2° in diameter, stout spreading often pendulous branches forming a low broad head, and reddish brown branchlets marked by prominent leaf-scars and numerous orange-colored lenticels; or often a shrub flowering when only a few feet tall. **Winter-buds** $\frac{1}{3}$′–$\frac{1}{2}$′ in length, with acuminate scales ciliate on the margin with rufous hairs. **Bark** of the trunk about $\frac{1}{8}$′ thick, light reddish brown tinged with orange, often marked by dark spots caused by the exuding of the resinous gum, and separating into large thin plate-like scales displaying the bright orange color of the inner bark. **Wood** heavy, hard, not strong, rich dark brown streaked with red, with thick light brown or yellow sapwood of 25–30 layers of annual growth. The resinous gum obtained from incisions made in the bark is emetic, purgative, and diuretic.

Distribution. Florida, shores of Bay Biscayne, on the Everglade Keys, and on Coot Bay in the rear of Cape Sable, Dade County, and on the southern keys; very abundant; in the Bahamas, Cuba, Jamaica, and Honduras.

4. RHUS L.

Trees or shrubs, with pithy branchlets, fleshy roots, and milky sometimes caustic or watery juice. Leaves unequally pinnate, or rarely simple. Flowers mostly dicœcious, rarely polygamous, white or greenish white, in more or less compound axillary or terminal panicles, the staminate and pistillate usually produced on separate plants; calyx-lobes united at base only, generally persistent; disk surrounding the base of the free ovary, coherent with the base of the calyx; petals longer than the calyx-lobes, inserted under the margin of the disk, opposite its lobes, deciduous; stamens 5, inserted on the margin of the disk alternate with the petals; filaments longer than the anthers; ovary ovoid or subglobose, sessile; styles 3, terminal, free or slightly connate at base, rising from the centre of the ovary. Fruit usually globose, smooth or covered with hairs; outer coat thin and dry, more or less resinous; stone crustaceous or bony. Seed ovoid or reniform, commonly transverse; cotyledons foliaceous, generally transverse; radicle long, uncinate, laterally accumbent.

Rhus is widely distributed, with more than one hundred species, in the extra-tropical regions of the northern and southern hemispheres. In North America the genus is widely and generally distributed from Canada to southern Mexico and from the shores of the Atlantic to those of the Pacific Ocean, with sixteen or seventeen species within the territory of the United States. Of these, four obtain the habit of small trees. The acrid poisonous juice of *Rhus vernicifera* DC., of China, furnishes the black varnish used in China and Japan in the manufacture of lacquer, and other species are valued for the tannin contained in their leaves or for the wax obtained from their fruit.

The name of the genus is from Ῥοῦς, the classical name of the European Sumach.

CONSPECTUS OF NORTH AMERICAN ARBORESCENT SPECIES.

Flowers in terminal thyrsoid panicles; fruit globular, clothed with acrid hairs; leaves unequally pinnate, deciduous; Sumachs.

Branches and leaf-stalks densely velvety hairy; leaflets 11–31, pale on the lower surface; fruit covered with long hairs; buds inclosed in the enlarged base of the petioles; juice milky. 1. **R. typhina** (A, C).

Branches and leaf-stalks pubescent; rachis winged; leaflets 9–21, green on the lower surface; fruit pilose; buds not inclosed by the petioles; juice watery. 2. **R. copallina** (A, C).

Flowers in axillary slender panicles; fruit glabrous, white; leaves unequally pinnate, deciduous; leaflets 7–13. 3. **R. vernix** (A, C).

Flowers in short compact terminal panicled racemes; fruit pubescent; leaves ovate, entire or serrate, simple or rarely trifoliolate, persistent. 4. **R. integrifolia** (G).

1. Rhus typhina L. Staghorn Sumach.

Rhus hirta Sudw.

Leaves 16′–24′ long, with a stout petiole usually red on the upper side and covered with soft pale hairs, enlarged at base and surrounding and inclosing the bud developed in its axil, and 11–31 oblong often falcate rather remotely and sharply serrate or rarely laciniate long-pointed nearly sessile or short-stalked leaflets rounded or slightly heart-shaped at base, covered above like the petiole and young shoots when they first appear with red caducous hairs, bright yellow-green until half grown, and at maturity dark green and rather opaque on the upper surface, pale or often nearly white on the lower surface, glabrous with the exception of the short fine hairs on the under side of the stout midrib, and primary veins forked near the margins, opposite, or the lower leaflets slightly alternate, those of the 3 or 4 middle pairs considerably longer than those at the ends of the leaf, 2′–5′ long, and 1′–1½′ wide; turning in the autumn before falling bright scarlet with shades of crimson

purple, and orange. **Flowers** opening gradually and in succession in early summer, the pistillate a week or ten days later than the staminate, on slender pedicels from the axils of small acute pubescent bracts, in dense panicles, with a pubescent stem and branchlets, and acuminate bracts ½′ to nearly 2′ long and deciduous with the opening of the flowers; panicle of the staminate flowers 8′–12′ long and 5′–6′ broad, with wide-spreading branches and nearly one third larger than the more compact panicle of the pistillate plant; calyx-lobes acute, covered on the outer surface with long slender hairs, much shorter than the petals in the staminate flower, and almost as long in the pistillate flower; petals of the staminate flower yellow-green sometimes tinged with red, strap-shaped, rounded at apex, becoming reflexed above the middle at maturity; petals of the pistillate flower green, narrow and acuminate, with a thickened and slightly hooded apex, remaining erect; disk bright red and conspicuous; stamens slightly exserted, with slender filaments and large bright orange-colored anthers; ovary ovoid, pubescent, the 3 short styles slightly connate at base, with large capitate stigmas, in the staminate flower glabrous, much smaller, unusually rudimentary. **Fruit** fully grown and colored in August and ripening late in the autumn in dense panicles 6′–8′ long and 2′–3′ wide, depressed-globose, with a thin outer covering clothed with long acrid crimson hairs and a small pale brown bony stone; **seed** slightly reniform, orange-brown.

Fig. 597

A tree, occasionally 35°–40° high, with copious white viscid juice turning black on exposure, a slender often slightly inclining trunk occasionally 12′–14′ in diameter, stout upright often contorted branches forming a low flat open head, and thick branchlets covered with long soft brown hairs gathered also in tufts in the axils of the leaflets, becoming glabrous after their third or fourth year, and in their second season marked by large narrow leaf-scars and by small orange-colored lenticels enlarging vertically and persistent for several years; more frequently a tall shrub, spreading by underground shoots into broad thickets. **Winter-buds** conic, thickly coated with long silky pale brown hairs, about ¼′ long. **Bark** of the trunk thin, dark brown, generally smooth, and occasionally separating into small square scales. **Wood** light, brittle, soft, coarse-grained, orange-colored, streaked with green, with thick nearly white sapwood. From the young shoots pipes are made for drawing the sap of the Sugar Maple. The bark, especially that of the roots, and the leaves are rich in tannin. A form with narrow deeply divided leaflets (f. *dissecta* Rehdr.) occasionally occurs.

Distribution. Usually on uplands in good soil, or less commonly on sterile gravelly banks and on the borders of streams and swamps, New Brunswick and through the valley

of the St. Lawrence River to southern Ontario and westward to eastern North Dakota and eastern and northeastern Iowa, and southward through the northern states and along the Appalachian Mountains; more abundant on the Atlantic seaboard than in the region west of the Appalachian Mountains.

Occasionally cultivated as an ornamental plant in the United States, and very commonly in central and northern Europe.

× *Rhus hybrida* Rehdr. a hybrid of *R. typhina* and *R. glabra* L. has been found in Massachusetts.

2. Rhus copallina L. Sumach.

Leaves 6′–8′ long, with a slender pubescent petiole and rachis more or less broadly wing-margined between the leaflets, the wings increasing in width toward the apex of the leaf, and 9–21 oblong or ovate-lanceolate leaflets entire or remotely serrate above the middle, sharp-pointed or rarely emarginate at apex, acute or obtuse and often unequal at

Fig. 598

base, those of the lower pairs short-petiolulate and smaller than those above the middle of the leaf, the others sessile with the exception of the terminal leaflet sometimes contracted into a long winged stalk, when they unfold dark green and slightly puberulous above, especially along the midrib, and covered below with fine silvery white pubescence, at maturity subcoriaceous, dark green and lustrous above, pale and pubescent below, $1\frac{1}{2}'$–$2\frac{1}{2}'$ long and about $\frac{3}{4}'$ wide, with slightly thickened revolute margins, a prominent midrib and primary veins; turning in the autumn before falling dark rich maroon color on the upper surface. **Flowers** appearing from June in the south to August in the north, those of the staminate plant opening in succession during nearly a month and continuing to unfold long after the petals of the pistillate plant have fallen, on stout pubescent pedicels $\frac{1}{8}'$–$\frac{1}{4}'$ long, in short compact pubescent panicles, the lower branches from the axils of the upper leaves, 4′–6′ long, 3′–4′ broad, and usually smaller on the female than on the male plant, their bracts and bractlets ovate or oblong, densely cinereo-pilose, deciduous before the expansion of the flowers; calyx puberulous on the outer surface, with ovate acute lobes one third as long as the ovate greenish yellow petals rounded at apex, becoming reflexed above the middle; disk red and conspicuous; stamens somewhat longer than the petals, with slender filaments and large orange-colored anthers, in the pistillate flower much shorter than the petals, with minute rudimentary anthers; ovary ovoid, pubescent, glabrous, much smaller in the staminate flower. **Fruit** ripening in five or six weeks and borne in stout compact often nodding pubescent clusters sometimes persistent on the branches

until the beginning of the following summer, $\frac{1}{8}'$ across, slightly obovoid, more or less flattened, with a thin bright red coat covered with short fine glandular hairs, and a smooth bony orange-brown stone; seed reniform, smooth, orange-colored, with a broad funicle.

A tree, 25°–30° high, with colorless watery juice, a short stout trunk 8′–10′ in diameter, erect spreading branches, and branchlets at first dark green tinged with red and more or less densely clothed with short fine or sometimes ferrugineous pubescence, appearing slightly zigzag at the end of their first season from the swellings formed by the prominent leaf-scars, and then pale reddish brown, slightly puberulous and marked by conspicuous dark-colored lenticels; or at the north usually a low shrub rarely more than 4°–5° tall. **Winter-buds** minute, nearly globose, and covered with dark rusty brown tomentum. **Bark** of the trunk $\frac{1}{3}'$–$\frac{1}{2}'$ thick, light brown tinged with red, and marked by large elevated dark red-brown circular excrescences, and separating into large thin papery scales. **Wood** light, soft, coarse-grained, light brown streaked with green and often tinged with red, with thin lighter colored sapwood of 4 or 5 layers of annual growth. The leaves are rich in tannin and are gathered in large quantities and ground for curing leather and for dyeing.

Distribution. Dry hillsides and ridges; widely and generally distributed from northern New England southward to eastern Kentucky, Tennessee and to southern Florida, and to southeastern Iowa, southeastern Nebraska, eastern Kansas and the valley of the San Antonio River, Texas; in Cuba; in the United States arborescent only southward; at the north rarely more than a few feet high and spreading by underground stems on gravelly sterile soil into broad thickets; varying considerably in the size and form of the leaflets. The most distinct and probably the most constant of these varieties is var. *lanceolata* A. Gray, a small tree growing on the prairies of eastern Texas to the valley of the Rio Grande and to southeastern New Mexico, often forming thickets on river bluffs or on the banks of small streams, and distinguished by its narrow acute often falcate leaflets and by its larger inflorescence and fruit. A tree sometimes 25°–30° high, with a trunk occasionally 8′ in diameter, covered by dark gray bark marked by lenticular excrescences. The flowers appear in July and August and the dull red or sometimes green fruit ripens in early autumn and falls before the beginning of winter.

Occasionally cultivated as an ornamental plant in the eastern United States, and in western and northern Europe.

3. Rhus vernix L. Poison Dogwood. Poison Sumach.

Leaves 7′–14′ long, with a slender usually light red or red and green petiole, and 7–13 obovate-oblong entire leaflets slightly unequal at base and narrowed at the acute or rounded apex, bright orange color and coated, especially on the margins and under surface, with fine pubescence when they unfold, soon becoming glabrous, and at maturity 3′–4′ long, $1\frac{1}{2}'$–2′ wide, dark green and lustrous above, pale below, with a prominent midrib scarlet above, primary veins forked near the margins, conspicuous reticulate veinlets, and revolute margins· turning early in the autumn before falling to brilliant shades of scarlet or orange and scarlet. **Flowers** about $\frac{1}{8}'$ long, appearing in early summer on slender pubescent pedicels bibracteolate near the middle, in long narrow axillary pubescent panicles crowded near the end of the branches, with acute pubescent early deciduous bracts and bractlets; calyx-lobes acute, one third the length of the yellow-green acute petals erect and slightly reflexed toward the apex; stamens nearly twice as long as the petals, with slender filaments and large orange-colored anthers, in the fertile flower not more than half the length of the petals, with small rudimentary anthers; ovary ovoid-globose, with short thick spreading styles terminating in large capitate stigmas. **Fruit** ripening in September and often persistent on the branches until the following spring, in long graceful racemes, ovoid, acute, often flattened and slightly gibbous, tipped with the dark remnants of the styles, glabrous, striate, ivory-white or white tinged with yellow, very lustrous, and about $\frac{1}{2}'$ long; stone conspicuously grooved, the wall thin, membranaceous; seed pale yellow.

A tree, with acrid poisonous juice turning black on exposure, occasionally 25° high, with

a trunk 5′–6′ in diameter, slender rather pendulous branches forming a narrow round-topped head, and slender glabrous branchlets reddish brown and covered with minute orange-colored lenticels when they first appear, orange-brown at the end of their first season, becoming light gray and marked by large elevated conspicuous leaf-scars; more

Fig. 599

often a shrub, with several slender clustered stems. **Winter-buds** acute and covered with dark purple scales puberulous on the back, and ciliate on the margins with short pale hairs, the terminal $\frac{1}{8}$′–$\frac{3}{4}$′ long and two or three times larger than the axillary buds. **Bark** of the trunk thin, light gray, smooth or sometimes slightly striate. **Wood** light, soft, coarse-grained, light yellow streaked with brown, with lighter colored sapwood.

Distribution. Wet swamps often inundated during a portion of the year; Quebec south to Sebring, Highlands County, Florida (*R. M. Harper*), southern Alabama, and westward to Ontario and southeastern Minnesota, western Louisiana and the valley of the Neches River (San Augustine County) eastern Texas; common and one of the most dangerous plants of the North American flora. An infusion of the young branches and leaves is employed in homœopathic practice, and the juice can be used as a black lustrous durable varnish.

4. Rhus integrifolia B. & H. Mahogany.

Leaves simple or very rarely 3-foliolate, persistent, acute or rounded at apex, with thickened revolute, or spinosely toothed margins (var. *serrata* Engler), puberulous when young, and at maturity 1$\frac{1}{2}$′–3′ long, 1′–1$\frac{1}{2}$′ wide, thick and coriaceous, dark yellow-green above, paler below, and glabrous with the exception of the stout petiole, broad thick midrib, and prominent reticulate veins. **Flowers** appearing from February to April, $\frac{1}{4}$′ in diameter when expanded, on short stout pedicels, with 2–4 broad-ovate pointed persistent scarious ciliate pubescent bractlets, in short dense racemes forming hoary-pubescent terminal panicles 1′–3′ in length; sepals rose-colored, orbicular, concave, ciliate on the margins, rather less than half the length of the rounded ciliate reflexed rose-colored petals; stamens as long as the petals, with slender filaments and pale anthers, minute and rudimentary in the pistillate flower; ovary broad-ovoid, pubescent, with 3 short thick connate styles and very large 3-lobed capitate stigmas, rudimentary in the staminate flower. **Fruit** $\frac{1}{2}$′ long, ovoid, flattened, more or less gibbous, thick, dark red, densely pubescent; stone kidney-shaped, smooth, light chestnut-brown, with thick walls; **seed** flattened, pale, with a broad dark-colored funicle covering its side.

A tree, rarely 30° high, with a short stout trunk 2°–3° in diameter, numerous spreading branches, and stout branchlets covered when they first appear with thick pale pubescence

disappearing in their second and third years, and bright reddish brown and marked by numerous small elevated lenticels; or usually a small often almost prostrate shrub. **Winter-buds** small, obtuse, covered with a thick coat of pale tomentum. **Bark** of the trunk $\frac{1}{4}'$–$\frac{1}{2}'$ thick, bright reddish brown, exfoliating in large plate-like scales. **Wood** hard, heavy,

Fig. 600

bright clear red, with thin pale sapwood of 8–10 layers of annual growth; valued and largely used as fuel. The fruit is occasionally employed in the preparation of a cooling beverage.

Distribution. Sandy sterile soil along sea beaches, and bluffs in the immediate vicinity of the ocean; neighborhood of Santa Barbara, Santa Barbara County, California, to the shores of Magdalena Bay, Lower California, and on the Santa Barbara and Cedros islands; on the mainland usually shrubby, forming close impenetrable thickets; in more sheltered situations and on the islands becoming arborescent; probably of its largest size on the shores of Todos Santos Bay, Lower California.

XXXII. CYRILLACEÆ.

Trees or shrubs, with small scaly buds and watery juice. Leaves alternate, entire, subcoriaceous, without stipules, persistent or tardily deciduous. Flowers small, regular, perfect, on slender bibracteolate pedicels, in terminal or axillary racemes; calyx 5–8-lobed, persistent, the lobes imbricated in the bud; petals 5–8, hypogynous; stamens 5–10, hypogynous, those opposite the petals shorter than the others; anthers oblong, introrse, 2-celled, the cells laterally dehiscent, opening longitudinally; ovary 2–4-celled; ovules suspended, anatropous; raphe dorsal; micropyle superior. Fruit an indehiscent capsule. Seed suspended; seed-coat membranaceous; albumen fleshy, radicle superior.

A family confined to the warmer parts of America, with three genera, of which two are represented by small trees in the southern states.

CONSPECTUS OF THE GENERA OF THE UNITED STATES.

Flowers in axillary racemes; calyx 5-lobed; petals 5 contorted in the bud; fruit without wings, 2-celled, with 2 seeds in each cell. **1. Cyrilla.**

Flowers in terminal racemes; calyx 5–8-lobed; petals 5–8 imbricated in the bud; fruit with 2–4 wings, 3 or rarely 4-celled, with 1 seed in each cell. **2. Cliftonia.**

1. CYRILLA L.

A glabrous tree or shrub, with spongy bark, slender terete branchlets conspicuously marked by large leaf-scars, and narrow acute winter-buds covered with chestnut-brown scales. Leaves usually clustered near the end of the branches, oblong or oblong-obovate, pointed, rounded, or slightly emarginate at apex, conspicuously reticulate-veined, short-petiolate. Flowers on pedicels from the axils of narrow alternate persistent bracts, in slender racemes from the axils of fallen leaves or of small deciduous bracts near the end of the branches of the previous year; calyx minute, divided nearly to the base into 5 ovate-lanceolate acute coriaceous lobes; petals 5, contorted in the bud, white or rose color, inserted on an annular disk, three or four times longer than the calyx-lobes, oblong-lanceolate, acute, concave, subcoriaceous, furnished below the middle on the inner surface with a broad glandular nectary; stamens 5, opposite the divisions of the calyx, inserted with and shorter than the petals; filaments subulate, fleshy; anther-cells united above the point of attachment, free below; ovary ovoid, free, sessile, pointed, 2-celled; styles short, thick; stigma 2-lobed, with spreading lobes; ovules 3 in each cell, suspended from an elongated placental process developed from the apex of the cell. Fruit 2-celled, broad-ovoid, crowned with the remnants of the persistent style; pericarp spongy. Seeds 2 in each cell, elongated, acuminate; embryo minute, cylindric, 2-lobed.

Cyrilla is represented by a single species of the coast region of the south Atlantic and Gulf states and of the Antilles and eastern tropical South America.

The name commemorates the scientific labors of Dominico Cirillo (1734–1799), the distinguished Italian naturalist and patriot.

1. Cyrilla racemiflora L. Ironwood. Leather Wood.

Leaves 2′–3′ long and $\frac{1}{4}$′–1′ wide, with a stout petiole $\frac{1}{8}$′–1′ in length; turning late in the autumn and early winter to brilliant shades of orange and scarlet and then deciduous, or southward persistent with little change of color until the beginning of the following summer. **Flowers** appearing late in June or early in July, in racemes usually 6–10 together and 4′–6′ long, at first erect, becoming pendulous before the fruit ripens. **Fruit** ripening in August and September, rarely more than $\frac{1}{16}$′ long; **seeds** light brown.

Fig. 601

A slender tree, occasionally 30°–35° high, with a stout often eccentric trunk 10′–14′ in diameter, dividing several feet above the ground into numerous wide-spreading branches, and slender branchlets bright brown during their first season and ultimately ashy gray;

often a broad bush sending up many slender stems 15°–20° high. **Winter-buds** about $\frac{1}{8}'$ long. **Bark** of the trunk rarely more than $\frac{1}{2}'$ thick except near the base of old trees, and covered by large thin bright red-brown scales. **Wood** heavy, hard, close-grained, not strong, brown tinged with red, with rather lighter colored sapwood. The spongy bark at the base of the trunk is pliable, absorbent, and astringent, and has been recommended as a styptic.

Distribution. Rich shaded river-bottoms, the borders of sandy swamps and shallow ponds of the coast Pine-belt, or on high sandy exposed ridges rising above streams near the Gulf coast; southeastern Virginia southward near the coast to northern Florida and westward along the Gulf coast to the valley of the Neches River, Texas; in Lake County, Florida, and ranging northward in Mississippi to Forrest County (near Hattiesburg, *T. G. Harbison*), and in Alabama to Dallas County; in swamps near the coast of western Florida often a low shrub with smaller leaves and shorter racemes (var. *parviflora* Sarg.); in Cuba, Jamaica, Porto Rico, Demarara, and Brazil (var. *racemifera* Sarg.).

2. CLIFTONIA Gærtn. f.

A glabrous tree or shrub, with thick dark brown scaly bark, slender terete branchlets marked by conspicuous leaf-scars, and small acuminate buds covered by chestnut-brown scales. Leaves oblong-lanceolate, rounded or slightly emarginate at apex, glandular-punctate, short-petiolate, persistent. Flowers on pedicels from the axils of large acuminate membranaceous alternate bracts deciduous before the opening of the flowers, in short terminal erect racemes; calyx 5–8-lobed, equal or unequal, broad-ovoid, rounded or acuminate at apex, much shorter than the 5–8 obovate unguiculate concave white or rose-colored sepals; stamens 10, opposite and alternate with the sepals, inserted with and shorter than the petals, 2-ranked, those of the outer rank longer than the others; filaments laterally enlarged near the middle, flattened below, subulate above; disk cup-shaped, surrounding the base of the oblong 2–4-winged 2–4-celled ovary; stigma subsessile, obscurely 2–4-lobed; ovules 2 in each cell, suspended from its apex. Fruit oblong, 2–4-winged, crowned with the remnants of the persistent style, 3 or rarely 4-celled; pericarp spongy, the wings thin and membranaceous. Seed 1 in each cell, terete, tapering to the ends, suspended; cotyledons very short.

Cliftonia is represented by a single species of the south Atlantic and Gulf states.

The generic name is in honor of Dr. Francis Clifton (d. 1736), an English physician.

1. Cliftonia monophylla Britt. Titi. Ironwood.

Leaves $1\frac{1}{2}'$–$2'$ long, $\frac{1}{2}'$–$1'$ wide, bright green and lustrous on the upper surface, paler on the lower surface; persistent until the autumn of their second year. **Flowers** fragrant,

Fig. 602

appearing in February and March, in racemes at first nodding, and conspicuous from the long exserted dark red-brown caducous bracts, becoming erect as the flowers open. **Fruit** about $\frac{1}{4}'$ long, ripening in August and September; **seeds** $\frac{1}{16}'$–$\frac{1}{8}'$ long, light brown.

A tree, occasionally 40°–50° high, with a stout often crooked or inclining trunk, occasionally 15′–18′ in diameter, and usually divided 12°–15° from the ground into a number of stout ascending branches, and slender rigid bright red-brown branchlets, becoming paler during their second and third seasons; or sometimes a shrub, with numerous straggling stout or slender stems frequently only a few feet high or occasionally 30°–40° high. **Winter-buds** about $\frac{1}{4}'$ long. **Bark** of young stems and of large branches thin, the surface separating into small persistent scales 1′–2′ long, becoming near the base of old trees deeply furrowed, dark red-brown, $\frac{1}{4}'$ thick, and broken on the surface into short broad scales. **Wood** heavy, close-grained, moderately hard, brittle, not strong, brown tinged with red, with thick lighter colored sapwood of 40–50 layers of annual growth; burning with a clear bright flame, and valued as fuel.

Distribution. Damp sandy peat soil in alluvial swamps and bays free from mud, lime, sulphur and salt, or often in shallow rarely overflowed swamps; coast region of the south Atlantic states from the valley of the Savannah River to the coast of western Florida, and through the maritime Pine-belt of the Gulf coast to eastern Louisiana.

XXXIII. AQUIFOLIACEÆ.

Trees or shrubs, with terete branchlets, scaly buds, and alternate simple entire crenate or pungently toothed petiolate persistent or deciduous leaves, with minute stipules. Flowers axillary, solitary or cymose, small, greenish white, dicœcious; calyx 4–6-lobed, the lobes imbricated in the bud, hypogynous; petals 4–6, oval or oblong, obtuse, free or united at base, imbricated in the bud; disk 0; stamens as many as and alternate with the petals and adnate to the base of the corolla; anthers introrse, 2-celled, the cells opening longitudinally, small and sterile in the pistillate flower; pistil compound; ovary 4–8-celled, minute and rudimentary in the staminate flower; style short or 0; stigmas as many as the cells of the ovary, nearly confluent; ovule generally solitary in each cell, suspended, anatropous; raphe usually dorsal, the micropyle superior. Fruit a drupe, with as many indehiscent bony or crustaceous 1-seeded nutlets as carpels; sarcocarp thin and fleshy. Seed narrowed at the ends, suspended; seed-coat membranaceous, pale brown; embryo minute in the apex of the copious fleshy albumen; cotyledons plain; the radicle superior.

The Holly family with five genera is distributed in temperate and tropical regions of the two hemispheres. Of the five genera now recognized, only Ilex is important in the number of species or is widely distributed.

1. ILEX L.

Characters of the family.

Ilex with about one hundred and seventy-five species is found in all tropical and temperate regions of the world with the exception of western North America, Australia, New Zealand, Tasmania, and New Guinea, the largest number of species occurring in Brazil and Guiana. Of the thirteen species which inhabit eastern North America, six are trees. Ilex contains a bitter principle, ilicin, and possesses tonic properties. *Ilex paraguariensis* St. Hilaire, of South America, furnishes the maté or Paraguay tea, and is the most useful of the species. The European *Ilex Aquifolium* L. is a favorite garden plant, and is sometimes planted in the middle, southern, and Pacific United States.

Ilex is the classical name of the Evergreen Oak of southern Europe.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT SPECIES.

Parts of the flower in 4's; pedicels with bractlets at the base; nutlets prominently ribbed on the back and sides; leaves persistent.

Leaves armed with spiny teeth; young branchlets glabrous or sparingly pubescent.

1. I. opaca (A, C).

Leaves serrate or entire; fruit bright red.
Leaves oblanceolate or oblong-obovate, mostly entire; young branchlets pubescent; calyx-lobes acuminate. 2. **I. Cassine** (C).
Leaves elliptic or oblong-elliptic, coarsely crenulate-serrate; young branchlets puberulous; calyx-lobes obtuse. 3. **I. vomitoria** (C).
Leaves entire, ovate, ovate-elliptic or ovate-lanceolate; fruit brownish purple. 4. **I. Krugiana** (D).
Parts of the flower in 4's or 5's, rarely in 6's; pedicels without bractlets; nutlets striate, many-ribbed on the back; leaves deciduous.
Leaves oblong-spatulate or obovate-lanceolate, remotely crenulate-serrate; calyx-lobes broad-triangular. 5. **I. decidua** (A, C).
Leaves ovate or oblong-lanceolate, sharply serrate; calyx-lobes acute. 6. **I. monticola** (A).

1. Ilex opaca Ait. Holly.

Leaves elliptic to obovate-oblong, pungently acute, with thickened undulate margins and few stout spinose teeth, or occasionally entire, especially on upper branches, thick, coriaceous, dull yellow-green, paler and often yellow on the lower surface, 2′–4′ long, with a prominent midrib and conspicuous veins; persistent on the branches for three years,

Fig. 603

finally deciduous in the spring; petioles short, stout, thickened at base, grooved above, slightly puberulent; stipules minute, broad-acute or nearly deltoid, persistent. **Flowers** appearing in spring on slender puberulous pedicels, with minute acute bractlets, in short pedunculate cymes from the axils of young leaves or scattered along the base of the young shoots, 3–9-flowered on the staminate and 1 or rarely 2 or 3-flowered on the pistillate plant; calyx-lobes acute, ciliate on the margins; stigmas broad and sessile. **Fruit** ripening late in the autumn, persistent on the branches during the winter, spherical or ovoid, dull red or rarely yellow, $\frac{1}{4}$′ in diameter; **nutlets** prominently few-ribbed on the back and sides, rather narrower at apex than at base.

A tree, often 40°–50° and occasionally 80°–100° high, with a trunk 2°, 3°, or exceptionally 4° in diameter, short slender branches forming a narrow pyramidal head, and stout branchlets covered when they first appear with fine rufous pubescence disappearing during their first season, and becoming glabrous and pale brown. **Winter-buds** obtuse or acuminate, $\frac{1}{8}$′–$\frac{1}{4}$′ long, with narrow acuminate ciliate scales. **Bark** about $\frac{1}{2}$′ thick, light gray and roughened by wart-like excrescences. **Wood** light, tough, not strong, close-grained,

nearly white when first cut, turning brown with age and exposure, with thick rather lighter colored sapwood; valued and much used in cabinet-making, in the interior finish of houses, and in turnery. The branches are used in large quantities for Christmas decoration.

Distribution. Coast of Massachusetts, in the city of Quincy, Norfolk County, southward generally near the coast to the shores of Mosquito Inlet and Charlotte Harbor, Florida; valley of the Mississippi River from southeastern Missouri and eastern and southern Arkansas, eastern Oklahoma, and Louisiana to the valley of Cibolo Creek (Southerland Springs, Wilson County), Texas; rare and of small size east of the Hudson River and rare in the Appalachian Mountain region and the country immediately west of it; most abundant and of its largest size on the bottom-lands of the streams of northern Louisiana, southern Arkansas and eastern Texas; at the north in dry rather gravelly soil often on the margins of Oak-woods, southward on the borders of swampy river-bottoms, in rich humid soil.

Occasionally cultivated in the eastern states as an ornamental plant.

2. Ilex Cassine L. Dahoon.

Leaves oblanceolate to oblong-obovate, acute, mucronate or rarely rounded and occasionally emarginate at apex, gradually narrowed and cuneate at base, revolute and entire, or sometimes serrate above the middle with sharp mucronate teeth, puberulous above and

Fig. 604

densely pubescent below when they first unfold, becoming glabrous at maturity with the exception of scattered hairs on the lower surface of the broad midrib, dark green and lustrous above, pale below, 1½′–3′ long and ½′–1′ wide; petioles short, stout, thickened at the base, sparingly villose. **Flowers** on hairy pedicels, with acute scarious bractlets, in pedunculate clusters, 3–9-flowered on the staminate plant, usually 3-flowered on the pistillate plant sometimes nearly 1′ long, from the axils of leaves of the year or occasionally of the previous year; calyx-lobes acute, ciliate. **Fruit** ripening late in the autumn, persistent until the following spring, globose, sometimes ¼′ in diameter, bright or occasionally dull red or nearly yellow, solitary or often in clusters of 3's; **nutlets** prominently few-ribbed on the back and sides; rounded at base, acute at apex.

A tree, 25°–30° high, with a trunk 12′–18′ in diameter, and branches coated at first with dense silky pubescence persistent until the end of the second or third year, ultimately dark brown and marked by occasional lenticels; or often a low shrub. **Winter-buds** minute, acute, with lanceolate scales thickly coated with pale silky pubescence. **Bark** of the trunk

about $\frac{1}{16}'$ thick, dark gray, thickly covered and roughened by lenticels. **Wood** light, soft, close-grained, not strong, pale brown, with thick nearly white sapwood.

Distribution. Cold swamps and on their borders, in rich moist soil, or occasionally on the high sandy banks of Pine-barren streams; South Carolina southward in the immediate neighborhood of the coast to the shores of Bay Biscayne and the Everglade Keys, Dade County, and in the interior of the peninsula in Polk and De Soto Counties, Florida, and along the Gulf coast to western Louisiana; on the Bahama Islands and in Cuba (var. *latifolia* Ait.); nowhere abundant on the Atlantic coast; most common in western Florida and southern Alabama; passing through forms with elongated narrow leaves (var. *angustifolia* Ait., the common form of southern Alabama) into the variety *myrtifolia* Sarg. This is a low shrub or occasionally a slender wide-branched tree, with pale nearly white bark, puberulous branchlets, and crowded generally entire mucronate leaves $\frac{1}{2}'$–$1'$ long, $\frac{1}{8}'$ wide, with strongly reflexed margins, a very short petiole, and a broad prominent midrib; an inhabitant of Cypress-swamps and Pine-barren ponds or their margins, in the neighborhood of the coast, North Carolina to Louisiana.

Ilex Cassine is occasionally cultivated in Europe.

3. Ilex vomitoria Ait. Cassena. Yaupon.

Leaves elliptic to elliptic-oblong, obtuse, coarsely and remotely crenulate-serrate, coriaceous, dark green and lustrous above, pale and opaque below, $1'$–$2'$ long and $\frac{1}{4}'$–$1'$ wide, persistent for two or three years, generally falling just before the appearance of the new

Fig. 605

growth of their third season; petioles short, broad, and grooved. **Flowers** on slender club-shaped glabrous pedicels, with minute bractlets at the base, in short glabrous cymes on branchlets of the previous year, those of the staminate plant short-stemmed and many-flowered, those of the pistillate plant sessile and 1 or 2-flowered; calyx-lobes rounded, obtuse, often slightly ciliate; ovary contracted below the broad flat stigma. **Fruit** produced in great abundance, on stems not more than $\frac{1}{4}'$ long, ripening late in the autumn or in early winter, soon deciduous, or persistent until spring, scarlet, nearly globose, about $\frac{1}{4}'$ in diameter; **nutlets** obtuse at the ends, and prominently few-ribbed on the back and sides.

A small much-branched tree, 20°–25° high, with a slender often inclining trunk rarely more than $6'$ in diameter, and stout branchlets standing at right angles with the stem, slightly angled and puberulous during their first season, becoming glabrous or nearly glabrous, terete and pale gray in their second year; generally a tall shrub, with numerous stems forming dense thickets. **Winter-buds** minute, obtuse, with narrow dark brown or often nearly black scales. **Bark** of the trunk $\frac{1}{16}'$–$\frac{1}{8}'$ thick, the light red-brown surface broken

into thin minute scales. **Wood** heavy, hard, close-grained, nearly white, turning yellow with exposure, with thick lighter colored sapwood.

Distribution. Southeastern Virginia to the St. John's River and Cedar Keys, Florida, and westward to the shores of Matagorda Bay and the valleys of the upper Rio Blanco and the Guadalupe River, Texas, and to southern Arkansas; in the Atlantic and east Gulf states rarely far from salt water (in Alabama northward to Autauga County), and usually not more than 10°–15° high; of its largest size and of tree-like habit only on the rich bottomlands of eastern Texas. The branches covered with the fruit are sold during the winter months for decorative purposes. An infusion of the leaves, which are emetic and purgative, was used by the Indians, who formerly visited the coast in large numbers every spring to drink it.

Occasionally used in the southern states for hedges.

4. Ilex Krugiana Loesen.

Leaves ovate, ovate-elliptic or ovate-lanceolate, acuminate and abruptly long-pointed or acute at apex, rounded or obtusely cuneate at base, entire, with slightly thickened margins subcoriaceous or coriaceous, glabrous, dark yellow-green and lustrous above, dull beneath,

Fig 606

persistent, $2\frac{1}{2}'$–$4'$ long and $1'$–$1\frac{1}{2}'$ wide, with a prominent midrib deeply impressed on the upper side and pale on the lower side, and 6–9 pairs of slender primary veins connected by thin reticulate veinlets; petioles slender, $\frac{1}{3}'$–$\frac{3}{4}'$ in length; stipules minute, whitish, persistent. Flowers on slender pedicels, $\frac{1}{12}'$–$\frac{1}{6}'$ long, in the axils of minute acute scarious deciduous bractlets, in crowded clusters, the staminate 1–3-flowered on short peduncles, the pistillate 1-flowered; calyx about $\frac{1}{12}'$ in diameter, 4-lobed, the lobes triangular, suberect, about as long as the tube, imbricated in the bud; corolla rotate, greenish white, petals 4, ovate or slightly obovate in the pistillate flower, imbricated in the bud; stamens 4 in the staminate flower, nearly as long as the petals; filaments slender, about as long as the oval anthers; in the pistillate flower much smaller and abortive; ovary 4-celled, ellipsoid; stigma small, discoid, obscurely 4-lobed; ovary of the staminate flower subconic, minute and abortive. Fruit on a stout pedicel up to $\frac{1}{5}'$ in length, globose, brownish purple, lustrous, $\frac{1}{6}'$ in diameter; sarcocarp thin; nutlets 4, irregularly 3-seeded, obtusely angled, dark brown.

In Florida a tree, sometimes 30°–40° high, with a tall often crooked trunk occasionally $4'$ in diameter and covered with thin smooth nearly white bark, becoming on old individuals darker-colored and broken into narrow scales, and small ascending branchlets green when they first appear, becoming light gray and finally white, and marked by numerous round elliptic lenticels; often a shrub.

Distribution. Florida, Homestead and Paradise Keys in the Everglades, Dade County; in the Bahama Islands, Hayti and San Domingo.

5. Ilex decidua Walt.

Leaves deciduous, except on vigorous shoots, fascicled at the end of short spur-like lateral branchlets, oblong-spatulate or spatulate-lanceolate, acuminate, obtuse or emarginate at apex, gradually narrowed below, remotely crenulate-serrate, 2′–3′ long, $\frac{1}{3}$′–1′ wide, thin early in the season, becoming thick and firm at maturity, light green above and pale and sparingly hairy along the narrow midrib below; petioles slender, grooved, pubescent, about $\frac{1}{4}$′ in length; stipules filiform, membranaceous. **Flowers** on slender pedicels, those of the staminate plant often $\frac{1}{2}$′ long and longer than those of the pistillate plant, in 1 or 2-flowered glabrous cymes crowded at the end of the lateral branches of the previous season, or rarely solitary on branchlets of the year; calyx-lobes triangular, with smooth or sometimes ciliate margins. **Fruit** on short stout stems, ripening in the early autumn, often remaining on the branches until the appearance of the leaves the following spring, globose or depressed-

Fig. 607

globose, orange or orange-scarlet, $\frac{1}{4}$′ in diameter; **nutlets** narrowed and rounded at base, acute or acuminate at apex, many-ribbed on the back.

A tree, 20°–30° high, with a slender trunk 6′–10′ in diameter, stout spreading branches, and slender glabrous pale silver gray branchlets; more often a tall straggling shrub. **Winter-buds** minute, obtuse, with ovate light gray scales. **Bark** of the trunk rarely more than $\frac{1}{16}$′ thick, light brown, and roughened by wart-like excrescences. **Wood** heavy, hard, close-grained, creamy white, with rather lighter colored sapwood.

Distribution. Borders of streams and swamps in low moist soil; Gloucester County, Virginia, to western Florida in the region between the eastern and southern base of the Appalachian Mountains and the neighborhood of the coast, and through the Gulf states to the valley of the Colorado River, Texas, and through Arkansas, eastern Oklahoma, and southern and eastern (St. Louis, Pike and Marion Counties) Missouri to southern Illinois, and southwestern Indiana (common in bottoms, Posey County, *C. C. Deam*); usually shrubby east of the Mississippi River and only arborescent in Missouri, southern Arkansas, and eastern Texas. In Florida a form (var. *Curtissii* Fern.) occurs with leaves only $\frac{1}{3}$′–$\frac{2}{3}$′ long and fruit about $\frac{1}{4}$′ in diameter.

6. Ilex monticola Gray.

Leaves deciduous, ovate to oblong-lanceolate, abruptly narrowed and acuminate or rarely acute at apex, cuneate or rarely rounded at base, sharply and rather remotely serrate with minute glandular incurved teeth, thin, glabrous, or sparingly hairy along the prom-

inent midrib and veins, 2′–5′ long, $\frac{1}{2}$′–$2\frac{1}{2}$′ wide, light green above and pale below; petioles slender, $\frac{1}{3}$′–$\frac{1}{2}$′ in length. **Flowers** appearing in June when the leaves are more than half grown, on slender pedicels $\frac{1}{2}$′ long on the staminate plant and much longer on the pistillate plant, in 1–2-flowered cymes crowded at the end of lateral spur-like branchlets of the previous year, or solitary on branchlets of the year; calyx-lobes acute, ciliate; ovary contracted below the broad flat stigma. **Fruit** globose, bright scarlet, nearly $\frac{1}{2}$′ in diameter; **nutlets** narrowed at the ends, prominently ribbed on the back and sides.

A tree, 30°–40° high, with a short trunk sometimes 10′–12′ in diameter, slender branches forming a narrow pyramidal head, and more or less zigzag glabrous branchlets pale red-

Fig. 608

brown at first, becoming dark gray at the end of their first season; more often a low shrub, with spreading stems. **Winter-buds** broad-ovoid to subglobose, about $\frac{1}{8}$′ long, with ovate keeled apiculate light brown scales. **Bark** of the trunk usually less than $\frac{1}{16}$′ thick, with a light brown surface roughened by numerous lenticels. **Wood** hard, heavy, close-grained, and creamy white.

Distribution. Central and western New York, southward along the Appalachian Mountains to eastern Tennessee; northern and central Georgia; coast of South Carolina near Charleston; western Florida (Mariana, Jackson County, and Wakulla Springs, Wakulla County); Dallas County, Alabama; northeastern Mississippi (Tishomingo County), and in West Feliciana and Wynn Parishes, Louisiana; a shrubby form with leaves soft pubescent beneath (var. *mollis* Britt.) occurs in western Massachusetts and Connecticut, and southward to North Carolina.

XXXIV. CELASTRACEÆ.

Trees or shrubs, with watery juice, and opposite or alternate simple persistent or deciduous leaves, with or without stipules. Flowers regular, perfect, polygamous or dicœcious, pedicellate in axillary clusters; calyx 4–5-lobed, the lobes imbricated in the bud; petals 4 or 5, imbricated in the bud; stamens 4 or 5; anthers introrse, 2-celled, the cells opening longitudinally; ovary 2–5-celled; ovules 2 or solitary in each cell (*6 in Canotia*), anatropous, or subhorizontal (*in Canotia*). Fruit a capsule or drupe. Seed with copious albumen; embryo axile.

A family of about thirty-eight genera widely distributed over the tropical and warm temperate parts of the world, with five arborescent representatives in the United States.

CONSPECTUS OF THE ARBORESCENT GENERA OF THE UNITED STATES.

Leaves opposite, deciduous; parts of the flower in 4's; fruit a fleshy capsule enclosed in a colored aril. 1. **Evonymus.**

Leaves alternate, persistent (*0 in 3*).

Fruit capsular; parts of the flower in 5's.

Capsule 3–4-valved, loculicidal, its outer coat woody, the valves apiculate at apex; base of the seed enclosed in a colored aril. 2. **Maytenus.**

Capsule 5-valved, septicidal, its outer coat thin and fleshy, the valves 2-lobed at apex; seed without an aril. 3. **Canotia.**

Fruit drupaceous; parts of the flower in 4's; seed without an aril.

Leaves often crenately serrate above the middle; stipules minute, caducous; fruit usually 1-seeded; branchlets quadrangular. 4. **Gyminda.**

Leaves entire; stipules 0; fruit 2-seeded; branchlets terete. 5. **Schæfferia.**

1. EVONYMUS L.

Small generally glabrous trees or shrubs, with usually square sometimes wing-margined branchlets, bitter drastic bark, slender obtuse or acuminate winter-buds, and fibrous roots. Leaves opposite, petiolate, entire, crenate or dentate, deciduous or rarely persistent; stipules minute, caducous. Flowers perfect or polygamo-dicœcious, in dichotomous axillary usually few-flowered cymes; calyx 4-lobed (in the North American arborescent species); disk thick and fleshy, cohering with and filling the short tube of the calyx, flat, 4-angled or lobed, closely surrounding and adhering to the ovary; petals inserted in the sinuses of the calyx under the free border of the disk, as many as and much longer than the calyx-lobes, spreading, deciduous; stamens as many as the petals and alternate with them, inserted on the summit of the disk; filaments very short, subulate, erect or recurved; anthers 2-celled, the cells nearly parallel or spreading below; ovary 4-celled; styles short, terminating in a depressed stigma; ovules usually 2 in each cell, ascending from the central angle; raphe ventral, micropyle inferior, or pendulous, the raphe then dorsal and the micropyle superior. Fruit capsular, 4-lobed and celled, fleshy, angled or winged, smooth (in the North American arborescent species), loculicidally 4-valved, the valves septicidal. Seeds 2 in each cell, or commonly solitary by abortion, ascending, surrounded by a colored aril; seed-coat chartaceous; albumen fleshy; embryo axile; cotyledons broad, coriaceous, parallel with the raphe; the radicle short, inferior.

Evonymus is widely distributed through the northern hemisphere, extending south of the equator to the islands of the Indian Archipelago and to Australia. About forty species are distinguished, the largest number occurring in the tropical regions of southern Asia, and in China and Japan. Of the four species found within the territory of the United States one only is a small tree. Many of the species are rich in bitter and astringent principles, and are drastic and slightly stimulant. Many are valued as ornaments of gardens and parks.

The generic name is from the classical name of one of the European species.

1. Evonymus atropurpureus Jacq. Burning Bush. Wahoo.

Leaves ovate-elliptic, acuminate, minutely serrate or biserrate, thin, puberulous below, 2′–5′ long and 1′–2′ wide, with a stout midrib and primary veins; turning pale yellow in the autumn and falling in October; petioles stout, ½′–1′ in length. **Flowers** appearing from May to the middle of June, nearly ½′ across, in twice or thrice dichotomous usually 7–15-flowered cymes borne on slender peduncles 1′–2′ long and conspicuously marked by the scars of minute bracts; calyx-lobes 4, rounded or rarely acute at apex, mostly entire; petals broad-obovate, undulate, often erose on the margins; anthers spreading. **Fruit** ripening in October, usually persistent on the branches until midwinter, deeply lobed, ½′ across, with light purple valves; seeds sometimes gibbous on the dorsal side, broad and

rounded above, narrowed below, ¼′ long, with a thin light chestnut-brown wrinkled coat and a thin scarlet aril.

A tree, rarely 20°–25° high, with a trunk 4′–6′ in diameter, spreading branches, and slender terete branchlets dark purple-brown at first, becoming lighter colored in their second season, often covered with small crowded lenticels, and marked by prominent leaf-scars, occasionally slightly or on vigorous shoots rarely broadly wing-margined; more often a shrub, 6°–10° tall. **Winter-buds** ⅛′ long, acute, with narrow purple apiculate

Fig. 609

scales scarious on the margins and covered by a glaucous bloom. **Bark** thin, ashy gray, and covered by thin minute scales. **Wood** heavy, hard, very close-grained, white tinged with orange.

Distribution. Borders of woods in rich soil; western New York to southern Minnesota, central Iowa, southeastern South Dakota, northwestern Nebraska, central Kansas, Oklahoma to the valley of the Canadian River (near Minton, Caddo County), southern Arkansas and eastern Texas (Dallas County), and southward to eastern Tennessee, and Jackson County, Alabama; in the valley of the upper Missouri River, Montana; arborescent only in southern Arkansas and Texas.

Occasionally cultivated as an ornament of gardens in the eastern United States and in Europe.

2. MAYTENUS Molina.

Small unarmed trees or shrubs with slender branchlets and minute buds. Leaves alternate often in two ranks, coriaceous, petiolate, persistent; stipules minute, deciduous. Flowers polygamous, small, white, yellow or red, axillary, solitary or in cymose or fascicled clusters; calyx 5-lobed; petals 5, spreading; stamens 5, inserted under the orbicular disk, with undulate margins; filaments filiform; anthers ovoid-cordate; ovary immersed and confluent with the disk, 2–4-celled; style 0 or columnar; stigma 2–4-lobed, usually sessile; ovules erect, solitary or in pairs in each cell. Fruit capsular, coriaceous, 2–4-valved; seed erect, surrounded at base or entirely in a pulpy aril; testa crustaceous; albumen fleshy or wanting; cotyledons foliaceous.

Maytenus with some seventy species is widely distributed in the tropical and subtropical regions of America from southern Florida, where one species occurs, to Brazil and Chile.

The Chilean *Maytenus boaria* Molina, a handsome tree of graceful habit, is occasionally cultivated in California.

The generic name is from Mayten, the Chilean name of one of the species.

1. Maytenus phyllanthoides Benth.

Leaves oblong-obovate to elliptic, rounded and rarely emarginate or acute at apex, gradually narrowed and cuneate at base and entire, deeply tinged with red when they unfold and at maturity, 1′–1½′ long and ½′–¾′ wide, with thickened often slightly undulate margins, a slender midrib, obscure primary veins, and conspicuous reticulate veinlets; petioles stout, ⅛′–¼′ in length. Flowers usually solitary or in compact fascicles, short-stalked, about 1/12′ in diameter; calyx-lobes rounded at apex, often persistent under the fruit, reddish, shorter than the white petals; ovary 3–4-celled. Fruit solitary, short-

Fig. 610

stalked, broad-obovoid, 4-angled, rounded and minutely mucronate at apex, abruptly narrowed below, bright red, ¼′–⅓′ long and broad, 1-celled, 3–4-valved, the valves opening to the base, ridged down the inner surface with a low ridge developed from the dissepiment, 2–4-seeded; seed ellipsoid, acute at the ends, 1/12′ long, surrounded at base by an open bright red aril.

A round-topped tree, rarely 20° high, with a trunk 1°–2° in diameter (*teste J. K. Small*), and slender alternate glabrous pale gray branchlets; usually a low shrub.

Distribution. Florida, west coast, Captiva Island, Lee County, to the neighborhood of Cape Sable; Cocoanut Grove, Dade County, and on many of the southern keys; on bluffs of Matagorda Bay near Corpus Christi, Nueces County, Texas; in northern Mexico and Lower California; probably of its largest size in Florida on Sands Key and on Captiva Island.

3. CANOTIA Torr.

A glabrous leafless tree, with light brown deeply furrowed bark, stout terete alternate branches terminating in rigid, pale green and striate spines, their base and those of the peduncles surrounded by black triangular persistent cushion-like processes minutely papillose on the surface. Flowers perfect, on slender spreading pedicels jointed below the middle, 3–7 together, in short-stemmed fascicles or corymbs near the end of the branches, from the axils of minute ovate subulate bracts; calyx 5-lobed, minute, persistent, much shorter than the oblong obtuse white hypogynous petals imbricated in the bud, reflexed at maturity above the middle, deciduous; stamens 5, hypogynous, opposite the lobes of the calyx; filaments awl-shaped, rather shorter than the petals, persistent on the fruit; anthers oblong, cordate, minutely apiculate, attached below the middle, grooved on the back; ovary raised upon and confluent with a fleshy slightly 10-angled gynophore, papillose-glandular on the surface, 5-celled, the cells opposite the petals, terminating in a fleshy elongated style; stigma slightly 5-lobed; ovules 6 in each cell, inserted in 2 ranks on its

inner angle, subhorizontal; micropyle inferior. Fruit a woody ovoid, acuminate capsule rounded at base, crowned with the subulate persistent style, septicidally 5-valved, the valves 2-lobed at apex; outer coat thin, fleshy; inner coat woody. Seed solitary or in pairs, ascending, subovoid, flattened; seed-coat subcoriaceous, papillate, produced below into a subfalcate membranaceous wing; embryo surrounded by thin fleshy albumen, erect; cotyledons oval, compressed; radicle very short, inferior.

The genus is represented by a single species.

The generic name is that by which this plant was known to the Mexicans of Arizona at the time of its discovery.

1. Canotia holacantha Torr.

Leaves 0. Flowers $\frac{1}{8}'$–$\frac{1}{4}'$ in diameter, appearing from June until October. Capsule 1′ long; seed about $\frac{3}{4}'$ in length.

A small shrub-like tree, sometimes 20°–30° high, with a short stout trunk rarely a foot in diameter; or often a low spreading shrub.

Fig. 611

Distribution. Dry gravelly mesas on the Arizona foothills, from the White Mountain region to the valley of Bill Williams's Fork in the northwestern part of the state, and on Providence Mountain in southern California.

4. GYMINDA Sarg.

Trees or shrubs, with pale quadrangular branchlets and minute acuminate buds. Leaves opposite, short-petiolate, oblong-obovate, rounded and sometimes emarginate at apex, entire or remotely crenulate-serrate above the middle with revolute thickened margins, feather-veined, coriaceous, persistent; stipules minute, acuminate, membranaceous, caducous. Flowers unisexual, pedicellate, in axillary pedunculate few-flowered dichotomously branched cymes bibracteolate at apex; calyx minute, 4-lobed, persistent, with a short urceolate tube and rounded lobes; disk fleshy, filling the tube of the calyx, cup-shaped, slightly 4-lobed; petals entire, obovate, white, rounded at apex, reflexed, much longer than the lobes of the calyx; stamens 4, opposite the sepals, inserted in the lobes of the disk, exserted, 0 in the pistillate flower; filaments slender, subulate, incurved; anthers oblong; ovary 2-celled, oblong, sessile, confluent with the disk, crowned with a large 2-lobed sessile stigma, rudimentary and deeply cleft in the staminate flower; ovule solitary, suspended from the apex of the cell; raphe dorsal; micropyle superior. Fruit drupaceous, 2-celled, 1 or 2-seeded, black or dark blue, oval or obovoid, crowned with the remnants of

the persistent stigma, often 1-celled by abortion; flesh thin; stone thick, crustaceous. Seed oblong, suspended; seed-coat membranaceous; albumen thin, fleshy; embryo axile; cotyledons ovate, foliaceous; radicle superior, next the hilum.

Gyminda with a single species is distributed from southern Florida to Trinidad and southern Mexico, and is represented in Central America by what is perhaps a second species.

The generic name is formed by transposing the first three letters of *Myginda*, to which this plant had been referred.

1. Gyminda latifolia Urb.

Gyminda Grisebachii Sarg.

Leaves 1½′–2′ long, ¾′–1′ broad, pale yellow-green. **Flowers** produced on shoots of the year from April to June. **Fruit** ripening in November, ¼′ long.

A tree, sometimes 20°–25° high, with a trunk rarely more than 6′ in diameter, and branchlets becoming terete during their third season and covered with thin slightly

Fig. 612

grooved roughened bright red-brown bark. **Bark** of the trunk thin, brown tinged with red, separating into thin minute scales. **Wood** very heavy, hard, close-grained, dark brown or nearly black, with thick light brown sapwood of 75–80 layers of annual growth.

Distribution. Florida, common and generally distributed over the southern keys from the Marquesas group to Upper Matecombe Key; in Cuba, Porto Rico, Trinidad, and southern Mexico. A form (var. *glaucescens*, Small.) with smaller less coriaceous very glaucous leaves occurs in Cuba.

5. SCHÆFFERIA Jacq.

Glabrous trees or shrubs, with slender rigid terete branches and small obtuse buds. Leaves alternate, or fascicled on short spur-like branchlets, entire, obovate or spatulate, acute and minutely apiculate or gradually narrowed to the rounded or emarginate apex, cuneate below, persistent, without stipules. Flowers dicœcious, pedicellate in axillary clusters from buds covered by scale-like persistent bracts; calyx 4-lobed, the lobes orbicular, persistent, much shorter than the 4 hypogynous, oblong, obtuse, white or greenish white petals; stamens 4, hypogynous, inserted under the margin of the small inconspicuous disk opposite the lobes of the calyx, wanting in the pistillate flower; filaments subulate, incurved; anthers oblong-ovoid; ovary 2-celled, ovoid, sessile, free, rudimentary in the

staminate flower; style very short, gradually enlarged into the large 2-lobed stigma, with spreading lobes; ovule solitary, ascending; raphe thin, ventral; micropyle inferior. Fruit a small 2-seeded fleshy drupe, ovoid or obovoid, crowned with the remnants of the persistent style, indistinctly 2-lobed by longitudinal grooves, slightly flattened; flesh thin and tuberculate; nutlets 2, obovoid, rounded at the ends, with a thick bony shell. Seed solitary, ascending; seed-coat membranaceous; albumen fleshy; cotyledons broad, foliaceous; radicle very short, inferior, next the hilum.

Schæfferia with four or five species is confined to the New World, with one species in southern Florida, and another, a small shrub, *Schæfferia cuneifolia* A. Gray in the arid region of western Texas and northern Mexico.

The generic name is in honor of Jakob Christian Schaeffer (1718–1790), the distinguished German naturalist.

1. Schæfferia frutescens Jacq. Yellow Wood. Box Wood.

Leaves bright yellow-green, 2′–2½′ long, ½′–1′ wide, with thick revolute margins, appearing in Florida in April and persistent on the branches until the spring of the following year; petioles short and broad Flowers opening in spring on branchlets of the year, ⅛′ across, the staminate generally 3 or 5 together on pedicels rarely more than ½′ long, the pistillato solitary or 2 or 3 together on pedicels rather longer than the petioles. Fruit ripening in Florida in November, slightly grooved, compressed, bright scarlet, with an acrid disagreeable flavor.

Fig. 613

A glabrous tree, 35°–40° high, with a trunk sometimes 8′–10′ in diameter, erect branches, and slender many-angled branchlets pale greenish yellow during their first season, becoming light gray during their second year and then conspicuously marked by the remains of the persistent wart-like clusters of bud-scales; or often a tall or low shrub. Bark of the trunk rarely more than ½′ thick, pale brown faintly tinged with red, the surface divided by long shallow fissures, and ultimately separating into long narrow scales. Wood heavy, close-grained, bright clear yellow, with thick rather lighter colored sapwood; sometimes used as a substitute for boxwood in wood engraving.

Distribution. Florida, upper Matecombe and Old Rhodes Keys, and eastward on the southern keys, and on the Everglade Keys, Dade County; on the Bahama Islands, and widely distributed through the West Indies to Venezuela.

XXXV. ACERACEÆ.

Trees or rarely shrubs, with limpid juice, terete branches, scaly buds, their inner scales accrescent and marking the base of the branchlets with ring-like scars, and fibrous roots. Leaves opposite, or on vigorous shoots rarely in whorls of 3, long-petiolate, simple, palmately 3–7-lobed and nerved or pinnately 3–7-foliolulate, usually without stipules, deciduous, in falling leaving small U-shaped narrow scars showing the ends of 3 equidistant fibro-vascular bundles. Flowers regular, diœciously or monœciously polygamous, rarely perfect or diœcious, in fascicles produced from separate lateral buds appearing in early spring before the leaves or in terminal and lateral racemes or panicles appearing with or later than the leaves; bracts minute, caducous; calyx colored, generally 5-parted, the lobes imbricated in the bud; petals usually 5, imbricated in the bud, or 0; disk annular, fleshy, more or less lobed, with a free margin; stamens 4–10, usually 7 or 8, inserted on the summit or inside of the disk, hypogynous; filaments distinct, filiform, commonly exserted in the staminate, shorter and generally abortive in the pistillate flower; anthers oblong or linear, attached at the base, introrse, 2-celled, the cells opening longitudinally; ovary 2-lobed, 2-celled, compressed contrary to the dissepiment, wing-margined on the back; styles 2, inserted between the lobes of the ovary, connate below and divided into 2 linear branches stigmatose on their inner surface; ovules 2 in each cell, collateral, rarely superposed, ascending, attached by their broad base to the inner angle of the cell, anatropous or amphitropous; micropyle inferior. Fruit composed of 2 samaras separable from a small persistent axis, the nut-like carpels compressed laterally, produced on the back into a large chartaceous or coriaceous reticulated obovate wing thickened on the lower margin. Seed solitary by abortion, or rarely 2 in each cell, ovoid, compressed, irregularly 3-angled, ascending obliquely, without albumen; seed-coat membranaceous, the inner coat often fleshy; embryo conduplicate; cotyledons thin, foliaceous or coriaceous, irregularly plicate, incumbent or accumbent on the elongated descending radicle turned toward the hilum.

A family of two genera, one widely distributed, the other, Dipteronia, distinguished by the broad wings encircling the mature carpels, and represented by a single Chinese species.

1. ACER L. Maple.

Characters of the family.

Acer with sixty or seventy species is widely distributed over the northern hemisphere, with a single species extending south of the equator to the mountains of Java. Acer produces light close-grained moderately hard wood valued for the interior finish of houses and in turnery. The bark is astringent, and the limpid sweet sap of some of the American species is manufactured into sugar.

Acer is the classical name of the Maple-tree.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT SPECIES.

Leaves simple, usually palmately lobed (*sometimes 3-foliolate in 1, 3-lobed at apex in 4*).
- Flowers appearing with or after the leaves.
  - Flowers with petals; sepals distinct.
    - Inflorescence corymbose.
      - Flowers in terminal drooping corymbs.
        - Leaves 3-lobed or parted. — 1. **A. glabrum** (B, F, G).
        - Leaves palmately 3–5-lobed. — 2. **A. circinatum** (B, G).
    - Inflorescence racemose.
      - Flowers in dense erect racemes. — 3. **A. spicatum** (A).
      - Flowers in drooping racemes.
        - Ovary and young fruit glabrous; leaves 3-lobed at apex. — 4. **A. pennsylvanicum** (A).
        - Ovary and young fruit hairy; leaves deeply 5-lobed. — 5. **A. macrophyllum** (G).

Flowers without petals; sepals united; inflorescence corymbose; pedicels long, pendulous, mostly hairy.
Leaves pale or glaucescent, or green and glabrous beneath.
Leaves green or pale beneath, glabrous or in one form villose-pubescent on the under side of the veins and on the petioles. 6. **A. saccharum** (A, C).
Leaves pale and pubescent, rarely glabrous beneath, their lobes usually short and obtuse or acuminate.
Lobes of the leaves only slightly lobed or entire; bark of young trees smooth and pale. 7. **A. floridanum** (C).
Lobes of the leaves distinctly lobulate; bark of young trees dark brown and scaly. 8. **A. grandidentatum** (F, H).
Leaves green and pubescent, rarely glabrous beneath.
Leaves hirsute-pubescent beneath and on the petioles, the lobes entire or lobulate, the basal sinus often closed by the lower lobes; bark dark and furrowed. 9. **A. nigrum** (A).
Leaves pilose-pubescent, rarely glabrous beneath, the lobes slightly lobulate, the basal sinus open; petioles glabrous; bark pale and smooth. 10. **A. leucoderme** (C).
Flowers appearing before the leaves in dense lateral clusters from separate buds; leaves 5-lobed (*3-lobed in varieties of 12*); fruit ripening in May or June.
Flowers sessile or short-stalked, without petals; ovary and young fruit tomentose. 11. **A. saccharinum.**
Flowers on long pedicels, with petals; ovary and young fruit glabrous. 12. **A. rubrum.**
Leaves 3–7-foliolate; flowers dicœcious, without petals. 13. **A. Negundo** (A, B, C, F, G, H).

1. Acer glabrum Torr. Dwarf Maple.

Leaves glabrous, thin, rounded in outline, cordate-truncate or cuneate at base, 3–5-lobed, the middle lobe usually narrowed and entire below the middle, or often 3-parted or 3-foliolate (f. *trisecta* Sarg.), with acute or obtuse doubly serrate lobes, 3′–5′ in diameter, dark

Fig. 614

green and lustrous on the upper, paler on the lower surface, with conspicuous veinlets; petioles stout, grooved, 1′–6′ in length, and often bright red. **Flowers** about $\frac{1}{8}$′ long on short slender pedicels, in loose few-flowered glabrous racemose corymbs on slender drooping peduncles from the end of 2-leaved branchlets, the staminate and pistillate usually produced separately on different plants; sepals oblong, obtuse, petaloid, as long as the

greenish yellow petals; stamens 7 or 8, with glabrous unequal filaments shorter than the petals, much shorter or rudimentary in the pistillate flower; ovary glabrous, with short obtuse lobes, rudimentary or 0 in the staminate flower; style divided to the base into 2 spreading stigmatic lobes as long as the petals. **Fruit** glabrous, with broad nearly erect or slightly spreading wings $\frac{3}{4}'$–$\frac{7}{8}'$ long, often rose-colored during the summer; **seeds** ovoid, bright chestnut-brown, **about** $\frac{1}{4}'$ long.

A small tree, occasionally 20°–30° high, with a short trunk 6′–12′ in diameter, small upright branches, and slender glabrous branchlets often slightly many-angled, pale greenish brown when they first appear, becoming bright red-brown during their first winter; often a shrub. **Winter-buds** acute, $\frac{1}{8}'$ long, with bright red or occasionally yellow scales, those of the inner ranks pale brown tinged with pink, tomentose on the inner surface, becoming $1\frac{1}{2}'$ long and narrow-spatulate. **Bark** of the trunk thin, smooth, and dark reddish brown. **Wood** heavy, hard, close-grained, light brown or often nearly white, with thick lighter colored sapwood.

Distribution. Borders of mountain streams usually at elevations of 5000°–6000°; Rocky Mountains from Montana to Wyoming, the Black Hills of South Dakota, Sioux County, Nebraska, Colorado, Utah, Nevada, northern Arizona, and to the Sacramento Mountains, New Mexico; in California from the Siskiyou Mountains along the Sierra Nevada to the East Fork of the Kaweah River, Kern County, at altitudes of 5000°–6000° at the north and of 8000°–9000° at the south. Passing into

Acer glabrum var. Douglasii Dippel.

Acer Douglasii Hook.

Leaves ovate or oblong-ovate, slightly cordate by a wide shallow sinus, truncate or rarely rounded at base, 3-lobed with acuminate lobes often slightly divided into acuminate lobules, the terminal leaflet usually ovate from a broad base, or occasionally gradually narrowed

Fig. 615

below and rhombic in outline and sharply serrate to the base or nearly to the base of the lobe with long-acuminate teeth pointing forward, dark green above, paler and often glaucescent below, $3\frac{1}{2}'$–$4'$ long and 3′–4′ wide, with 3 prominent nerves extending to the points of the lobes, and slender veins; petioles glabrous, 1′–$3\frac{1}{2}'$ in length. **Flowers** as in the species. **Fruit** with erect or nearly erect wings, $\frac{3}{4}'$–$1'$ long and $\frac{1}{3}'$–$\frac{1}{2}'$ wide.

A tree, occasionally 40° high, with a short trunk 12′–18′ in diameter, small upright branches and slender bright red-brown branchlets.

Distribution. Coast of southern Alaska (head of Lynn Canal), southward near the coast to Vancouver Island and western Washington, and eastward on the high mountains of Washington to the Blue Mountains of eastern Oregon, western Idaho and northern Montana; on Loomis Creek, Natrona County, Wyoming.

2. Acer circinatum Pursh. Vine Maple.

Leaves almost circular in outline, cordate at base by a broad shallow sinus, or sometimes almost truncate, palmately 7–9-lobed occasionally nearly to the middle, with acute lobes sharply and irregularly doubly serrate, and conspicuously palmately nerved, with

Fig. 616

prominent veinlets, when they unfold tinged with rose color, and puberulous, especially on the lower surface and on the petioles, and at maturity glabrous with the exception of tufts of pale hairs in the axils of the large veins, thin and membranaceous, dark green above, pale below, and 2′–7′ in diameter; in the autumn turning orange and scarlet; petioles stout, grooved, 1′–2′ in length, clasping the stem by their large base. **Flowers** appearing when the leaves are about half grown, in loose 10–20-flowered umbel-like corymbs pendent on long stems from the end of slender 2-leaved branchlets, the staminate and pistillate flowers produced together; sepals oblong to obovate, acute, villose, purple or red, much longer than the greenish white broad, cordate petals folded together at apex; stamens 6–8, with slender filaments villose at base, exserted in the staminate flower, much shorter than the petals in the pistillate flower; ovary glabrous, with spreading lobes, in the staminate flower reduced to a small point surrounded by a tuft of pale hairs; style divided nearly to the base into long exserted stigmas. **Fruit** with thin wings, 1½′ long, spreading almost at right angles, red or rose color like the nutlets in early summer, ripening late in the autumn; **seeds** smooth, pale chestnut-brown, ⅛′–¼′ long.

A tree, rarely 30°–40° high, often vine-like or prostrate, with a trunk 10′–12′ in diameter, and glabrous pale green or reddish brown branchlets frequently covered during their first winter with a glaucous bloom, and occasionally marked by small lenticels; often a low wide-spreading shrub. **Winter-buds** ⅛′ long, rather obtuse, with thin bright red outer scales rounded on the back, and obovate-spatulate inner scales rounded at apex, contracted into a long narrow claw, bright rose-colored and more or less pubescent, especially on the outer surface, and when fully grown often 2′ long and ¼′ broad. **Bark** of the trunk thin, smooth, bright red-brown, marked by numerous shallow fissures. **Wood** heavy, hard, close-grained, not strong, light brown, sometimes nearly white, with thick lighter colored sapwood; used

for fuel, the handles of axes and other tools, and by the Indians of the northwest coast for the bows of their fishing-nets.

Distribution. Banks of streams; coast of British Columbia through western Washington and Oregon to Mendocino County, and the cañon of the upper Sacramento River, California; one of the most abundant of the deciduous-leaved trees of western Washington and Oregon up to altitudes of 4000° above the sea, and of its largest size on the rich alluvial soil of bottom-lands, its vine-like stems in such situations springing 4 or 5 together from the ground, spreading in wide curves and sending out long slender branches rooting when they touch the ground and forming impenetrable thickets of contorted and interlaced trunks, often many acres in extent; in California smaller and less abundant, growing along streams in the coniferous forest or rarely on dry ridges up to an altitude of 4000° in the northeastern part of the state.

Occasionally cultivated as an ornamental plant in Europe, and in the eastern states, and hardy as far north as eastern Massachusetts.

3. Acer spicatum Lam. Mountain Maple.

Leaves subcordate or sometimes truncate at base, conspicuously 3-nerved, 3 or slightly 5-lobed, with gradually narrowed pointed lobes, and sharply and coarsely glandular-serrate, when they unfold puberulous on the upper surface and densely tomentose on the

Fig. 617

lower surface, and at maturity thin, 4′–5′ long and broad; turning in the autumn to various shades of orange and scarlet; petioles slender, enlarged at base, 2′–3′ in length, often becoming scarlet in summer. **Flowers** opening in June after the leaves are fully grown, $\frac{1}{4}$′ diameter, on slender pedicels $\frac{1}{2}$′–$\frac{3}{4}$′ long, the pistillate toward the base and the staminate at the apex of a narrow many-flowered long-stemmed upright slightly compound pubescent raceme; calyx-lobes narrow-obovate, yellow, pubescent on the outer surface, much shorter than the linear-spatulate pointed yellow petals; stamens 7 or 8, inserted immediately under the ovary, with slender glabrous filaments as long as the petals in the sterile flower, about as long as the sepals in the pistillate flower, and glandular anthers; ovary hoary-tomentose, reduced to a minute point surrounded by a tuft of pale hairs in the staminate flower; style columnar, almost as long as the petals, with short stigmatic lobes. **Fruit** fully grown and bright red or yellow in July, turning brown late in the autumn, almost glabrous, with more or less divergent wings about $\frac{1}{2}$′ long; **seeds** smooth, dark red-brown, $\frac{1}{8}$′ long.

A bushy tree, occasionally 25°–30° high, with a short trunk 6′–8′ in diameter, small upright branches, and slender branchlets light gray and pubescent when they first appear,

becoming glabrous during the summer, bright red during their first winter, gray or pale brown the following season, and blotched or streaked with green toward the base; more often a tall or low shrub. **Winter-buds** acute; the terminal $\frac{1}{8}'$ long, with bright red outer scales more or less coated with hoary tomentum, those of the inner ranks becoming at maturity 1′ or more in length and then lanceolate, pale and papery; axillary buds much smaller and glabrous or puberulous. **Bark** of the trunk very thin, reddish brown, smooth or slightly furrowed. **Wood** light, soft, close-grained, light brown tinged with red, with thick lighter colored sapwood.

Distribution. Moist rocky hillsides usually in the shade of other trees, and really arborescent only on the western slopes of the high mountains of Tennessee and North Carolina; Newfoundland and Labrador to Hudson Bay, Manitoba, and Saskatchewan, and southward through the northern states, and westward to Minnesota and northeastern Iowa, and along the Appalachian Mountains.

Occasionally cultivated as an ornament of parks and gardens in the northern states.

4. Acer pennsylvanicum L. Striped Maple. Moose Wood.

Leaves rounded or cordate at base, palmately 3-nerved, 3-lobed at apex, with short lobes contracted into a tapering serrate point, and finely and sharply doubly serrate, when they unfold thin, pale rose color and coated with ferrugineous pubescence, especially on the

Fig. 618

lower surface and on the petioles, and at maturity glabrous with the exception of tufts of ferrugineous hairs in the axils of the principal nerves on the two surfaces, thin, pale green above, rather paler below, 5′–6′ long and 4′–5′ wide; turning in the autumn clear light yellow; petioles stout, grooved, $1\frac{1}{2}'$–2′ in length, with an enlarged base nearly encircling the branch. **Flowers** bright canary-yellow, opening toward the end of May or early in June when the leaves are nearly fully grown, on slender pedicels $\frac{1}{4}'$–$\frac{1}{2}'$ long, in slender drooping long-stemmed racemes 4′–6′ in length, the staminate and pistillate usually in different racemes on the same plant; sepals linear-lanceolate to obovate, $\frac{1}{4}'$ long and a little shorter and narrower than the obovate petals; stamens 7–8, shorter than the petals in the staminate flower, rudimentary in the pistillate flower; ovary purplish brown, glabrous, in the staminate flower reduced to a minute point; styles united nearly to the top, with spreading recurved stigmas. **Fruit** in long drooping racemes, glabrous, with thin spreading wings $\frac{3}{4}'$ long, and marked on one side of each nutlet by a small cavity; **seeds** $\frac{1}{4}'$ long, dark red-brown, and slightly rugose.

A tree, 30°–40° high, with a short trunk 8′–10′ in diameter, small upright branches, and slender smooth branchlets pale greenish yellow at first, bright reddish brown during their

first winter, and at the end of two or three years striped like the trunk with broad pale lines; or often much smaller and shrubby in habit. **Winter-buds**: the terminal conspicuously stipitate, sometimes almost $\frac{1}{2}'$ long, much longer than the axillary buds, covered by two thick bright red spatulate boat-shaped scales prominently keeled on the back, the inner scales green and foliaceous, becoming $1\frac{1}{2}'$–$2'$ long, $\frac{1}{2}'$ wide, pubescent, and bright yellow or rose color. **Bark** of the trunk $\frac{1}{8}'$–$\frac{1}{4}'$ thick, reddish brown, marked longitudinally by broad pale stripes, and roughened by many oblong horizontal excrescences. **Wood** light, soft, close-grained, light brown, with thick lighter colored sapwood of 30–40 layers of annual growth.

Distribution. Usually in the shade of other trees, often forming in northern New England a large part of their shrubby undergrowth; shores of Ha-Ha Bay, Quebec, westward along the shores of Lake Ontario and the islands of Lake Huron to northern Wisconsin, and southward through the Atlantic states and along the Appalachian Mountains to northern Georgia; ascending to altitudes of 5000°; common in the north Atlantic states, especially in the interior and elevated regions; of its largest size on the slopes of the Big Smoky Mountains, Tennessee, and of the Blue Ridge in North and South Carolina.

Sometimes cultivated as an ornamental tree in the northern states, and occasionally in Europe.

5. Acer macrophyllum Pursh. Broad-leaved Maple.

Leaves more or less cordate at the broad base, deeply 5-lobed by narrow sinuses acute in the bottom, the lobes acute or acuminate, the terminal lobe often 3-lobed, the others usually furnished with small lateral lobules, the lower lobes much smaller than the others, promi-

Fig. 619

nently 3–5-nerved, puberulous when they unfold, especially on the upper surface along the principal veins, and at maturity subcoriaceous, dark green and lustrous on the upper surface, pale on the lower surface, 8′–12′ in diameter; turning in the autumn bright orange color before falling; petioles stout, 10′–12′ in length, with enlarged bases united and encircling the stem and often furnished on the inside with small tufts of white hairs. **Flowers** bright yellow, fragrant, $\frac{1}{4}'$ long, on slender pubescent often branched pedicels $\frac{1}{2}'$–$\frac{3}{4}'$ in length, the staminate and pistillate together in graceful pendulous slightly puberulous racemes 4′–6′ long, appearing in April and May after the leaves are fully grown; sepals petaloid, obovate, obtuse and a little longer and broader than the spatulate petals; stamens 9–10, with long slender filaments hairy at base, exserted in the staminate flower and included in the pistillate flower, and orange-colored anthers; ovary hoary-tomentose, reduced in the staminate flower to a minute point; styles united at base only; stigmas long and exserted. **Fruit**

fully grown by the 1st of July and ripening late in the autumn; nutlets covered with long pale hairs, their wings $1\frac{1}{2}'$ long, $\frac{1}{2}'$ wide, slightly divergent and glabrous with the exception of a few hairs on the thickened edge; **seeds** dark-colored, rugose and pitted, $\frac{1}{4}'$ long.

A tree, 80°–100° high, with a tall straight trunk 2°–3° in diameter, stout often pendulous branches forming a compact handsome head, and stout branchlets smooth and pale green at first, becoming bright green or dark red in their first winter, covered more or less thickly with small longitudinal white lenticels, and in their second summer gray or grayish brown. **Winter-buds** obtuse; terminal $\frac{1}{4}'$ long, with short broad slightly spreading dark red ciliate outer scales rounded on the back, those of the inner ranks green and foliaceous, and at maturity $1\frac{1}{2}'$ long, colored and puberulous; axillary buds minute. **Bark** of the trunk $\frac{1}{2}'$–$\frac{3}{4}'$ thick, brown faintly tinged with red or bright reddish brown, deeply furrowed and broken on the surface into small square plate-like scales. **Wood** light, soft, not strong, close-grained, rich brown tinged with red, with thick lighter colored often nearly white sapwood of 60–80 layers of annual growth; more valuable than the wood produced by other deciduous-leaved trees of western North America, and in Washington and Oregon used in the interior finish of buildings, for furniture, and for axe and broom-handles.

Distribution. Banks of streams or on rich bottom-lands or the rocky slopes of mountain valleys; coast of Alaska south of latitude 55° north, southward along the islands and coast of British Columbia, through Washington and Oregon west of the Cascade Mountains, and southward along the coast ranges and the western slopes of the Sierra Nevada to the San Bernardino Mountains, and to Hot Spring Valley, San Diego County, California; on the Sierra Nevada usually between altitudes of 2000° and 5000° and on the southern mountains rarely above 3000°; most abundant and of its largest size in the humid climate and rich soil of the bottom-lands of southwestern Oregon, forming extensive forests; in California usually much smaller, especially on the coast ranges.

Generally planted in the Pacific States for shade and as a street tree, and occasionally in the Eastern States as far north as Long Island, New York, and in western Europe; not hardy in Massachusetts.

6. Acer saccharum Marsh. Sugar Maple. Rock Maple.

Leaves rarely in whorls of 3, heart-shaped by a broad sinus, truncate or sometimes cuneate at base, 3–5-lobed, the lobes usually acute sparingly sinuate-toothed usually 3-lobulate at apex, with 3–5 conspicuous nerves, and reticulate veinlets, when they unfold coated below with pale pubescence, glabrous or more or less pubescent on the nerves below (var. *Schneckii* Rehd.) and at maturity, 4′–5′ in diameter, often rather coriaceous, dark green and opaque on the upper surface, green or pale (var. *glaucum* Sarg.) on the lower surface; turning in the autumn brilliant shades of deep red, scarlet and orange or clear yellow; petioles slender, glabrous, $1\frac{1}{2}'$–3′ in length. **Flowers** appearing with the leaves on slender more or less hairy pedicels $\frac{3}{4}'$–3′ long, in nearly sessile umbel-like corymbs from terminal leaf-buds and lateral leafless buds, the staminate and pistillate in the same or in separate clusters on the same or on different trees; calyx broad-campanulate, 5-lobed by the partial union of the obtuse sepals, greenish yellow, hairy on the outer surface; corolla 0; stamens 7–8, with slender glabrous filaments twice as long as the calyx in the staminate flower and much shorter in the pistillate flower; ovary obtusely lobed, pale green, covered with long scattered hairs, in the staminate flower reduced to a minute point; styles united at base only, with 2 long exserted stigmatic lobes. **Fruit** ripening in the autumn, glabrous, with broad thin and usually divergent wings $\frac{1}{2}'$–$1'$ long; **seeds** smooth, bright red-brown, $\frac{1}{4}'$ long.

A tree, 100°–120° high, with a trunk often 3°–4° in diameter, rising sometimes in the forest to the height of 60°–70° without branches, or in open situations developing 8°–10° from the ground stout upright branches forming while the tree is young a narrow egg-shaped head, ultimately spreading into a broad round-topped dome often 70°–80° across, and slender glabrous branchlets green at first, becoming reddish brown by the end of their first season, lustrous, marked by numerous large pale oblong lenticels, and in their second winter pale brown tinged with red. **Winter-buds** acute, $\frac{1}{4}'$ long, with purple slightly puber-

ulous outer scales, and inner scales becoming 1½′ long, narrow-obovate, short-pointed at apex, thin, pubescent, and bright canary yellow. **Bark** of young stems and of large branches pale, smooth or slightly fissured, becoming on large trunks ½′–¾′ thick and broken into deep longitudinal furrows, the light gray-brown surface separating into small plate-like scales. **Wood** heavy, hard, strong, close-grained, tough, light brown tinged with red, with thin sapwood of 30–40 layers of annual growth; largely used for the interior finish of buildings, especially for floors, in the manufacture of furniture, in turnery, shipbuilding, for shoe-lasts and pegs, and largely as fuel. Accidental forms with the grain curled and contorted, known as curly maple and bird's-eye maple, are common and are highly prized in cabinet-making. The ashes of the wood are rich in alkali and yield large quantities of potash. Maple sugar is principally made from the sap of this tree.

Distribution. Newfoundland and Nova Scotia, westward to the Lake of the Woods, Ontario, and southward through eastern Canada and the northern states, and along the Appalachian Mountains to northern Georgia; in central Alabama and Mississippi, and

Fig. 620

westward in the United States to Minnesota, northeastern South Dakota (coulées of Little Minnesota River, Roberts County), central and northwestern Iowa, eastern Kansas, central Oklahoma, and eastern Louisiana; most abundant northward; ascending in North Carolina the Alleghany Mountains to altitudes of 3000°; the var. *glaucum* rare and local in the north from Prince Edwards Island and Lake St. John, Quebec, to Iowa and southward to Pennsylvania, Ohio and central Tennessee; more abundant southward; apparently the only form but not common in South Carolina, Alabama, Mississippi, Louisiana and southern Arkansas; the var. *Schneckii* with leaves glaucous or glaucescent below and more or less densely pubescent with spreading hairs, on the under side of the midrib and veins and on the petioles, southern Indiana and Illinois to western Kentucky and western and middle Tennessee, northwestern Georgia (near Rome, Floyd County), and to eastern Missouri southward to Williamsville, Wayne County.

Commonly planted as a shade and ornamental tree in the northern states. A form of columnar habit (var. *monumentale* Schwerin) is occasionally cultivated.

More distinct are the following varieties:

Acer saccharum var. Rugelii Rehd.

Leaves thick, 3′–5′ long and 4′–6′ wide, pale and glabrous below, 3-lobed by broad rounded sinuses, rounded or slightly cordate at base, the lobes long-acuminate, usually entire, the middle lobe occasionally slightly undulate, the lateral lobes spreading, sometimes furnished near the base with a short acute lobule.

Distribution. Southeastern Ohio to western Pennsylvania (Kittaning, Armstrong County) and eastern and middle Tennessee, and to southern Ontario, the southern peninsula of Michigan, eastern and central Indiana, southern Illinois, eastern Missouri and northwestern Arkansas (Eureka Springs, Carroll County); rare and local in its extreme form; its 3-lobed leaves sometimes appearing on upper branches of trees bearing on lower branches leaves of the typical Sugar Maple.

Fig. 621

Acer saccharum var. sinuosum Sarg.

Acer sinuosum Rehd.

Leaves suborbicular, broader than long, 3–5-lobed with short triangular-ovate to triangular-oblong obtuse lobes, entire or on vigorous shoots occasionally dentate, usually broad-cordate at base, often with the nerves of the two lateral lobes projecting into the

Fig. 622

broad sinus and forming its base, when they unfold glabrous and purplish above, loosely hairy below, soon glabrous, and at maturity dark yellow-green and lustrous on the upper surface, pale, reticulate-venulose and glabrous except in the axils of the principal veins on the lower surface, 3–5-nerved, usually not more than $1\frac{1}{2}'$ long, occasionally up to $2\frac{3}{4}'$ long and 3′ wide; petioles slender, glabrous, $\frac{1}{2}'$–$1\frac{1}{2}'$ in length. **Flowers** appearing with the leaves, on slender glabrous pedicels, $\frac{1}{2}'$–$1\frac{1}{4}'$ long, in 3–8-flowered nearly sessile corymbs; calyx broad-campanulate or cupulate, with short semiorbicular lobes ciliate on the margins; petals 0; stamens usually 6, with slender filaments longer than the calyx of the staminate flower; style divided to below the middle, with two spreading stigmas. **Fruit** glabrous, with long and broad almost horizontally spreading nutlets, convex, smooth, pale yellow-brown, the wing curved upward.

A tree, rarely more than 20° high with a short trunk 8′–10′ in diameter, small branches forming an open irregular head, and slender glabrous branchlets light green above when they first appear, becoming pale red-brown and marked by pale lenticels during their first season and ultimately dull gray-brown. **Bark** of the trunk smooth, pale gray. **Winter-buds** small, obtuse, covered with dark brown scales, those of the inner ranks accrescent, linear-oblong, scarlet or pink, up to $1\frac{1}{8}'$ in length when fully grown.

Distribution. Edwards Plateau of western Texas, banks and bluffs of Cibelo Creek, near Boerne, Kendall County, on the rocky banks of upper Saco Creek, Bandera County, and at the base of a high limestone bluff near Utopia, Uvalde County; rare and local.

7. Acer floridanum Pax. Sugar Maple.

Leaves rounded, truncate or slightly cordate at the broad base, 3–5-lobed, with short obtuse or acute entire or lobulate lobes, when they unfold sparingly hairy on the upper surface and hoary-tomentose on the lower surface, and at maturity thin, dark green and lustrous

Fig. 623

above, pale or glaucescent and pubescent below, $1\frac{1}{2}'$–3′ in diameter, and prominently 3–5-nerved, with stout spreading lateral veins and conspicuous reticulate veinlets; turning yellow and scarlet in the autumn before falling; petioles slender, glabrous, or pubescent generally becoming glabrous, $1\frac{1}{2}'$–3′ in length, with an enlarged base nearly encircling the branchlet. **Flowers** appearing with the leaves on slender elongated sparingly hairy ultimately glabrous or villose-tomentose (var. *villipes* Rehd.) pedicels, in many-flowered drooping nearly sessile corymbs; calyx campanulate, yellow, about $\frac{1}{8}'$ long, persistent under the fruit, the short lobes ciliate on the margins with long pale hairs; corolla 0. **Fruit** green,

sparingly villose until fully grown, usually becoming glabrous, with spreading occasionally erect wings $\frac{3}{8}'$–$\frac{3}{4}'$ long; **seeds** smooth, bright red-brown, about $\frac{1}{4}'$ long.

A tree, occasionally 50°–60° high, with a trunk rarely 3° in diameter, small erect and spreading branches, and slender glabrous or more or less densely villose-tomentose (var. *villipes* Rehdr.) branchlets, light green when they first appear, becoming rather light red-brown during their first season, and covered with minute pale lenticels; usually smaller. **Winter-buds** obtuse, about $\frac{1}{8}'$ long, with dark chestnut-brown obtuse scales and bright rose-colored linear-spatulate inner scales often 1′ long when fully grown. **Bark** of the trunk thin, smooth, pale, becoming near the base of old trees thick, dark, and deeply furrowed.

Distribution. River banks and low wet woods, southeastern Virginia (near McKinney, Dinwiddie County, *W. W. Ashe*), valley of the Roanoke River near Weldon, Halifax County, North Carolina, and southward to southern Georgia and western Florida to Lafayette County; near Selma, Dallas County, Alabama; West Feliciana Parish and through western Louisiana to eastern Texas (Harrison and San Augustine Counties), and southern Arkansas (Fulton, Hempstead County); the var. *villipes* near Raleigh, Wake County, North Carolina, Calhoun Falls, Abbeville County, South Carolina, Shell Bluff on the Savannah River, Burke County, Cuthbert, Randolph County, and Columbus, Muscogee County, Georgia; River Junction, Gadsden County, Florida, and on the San Luis Mountains, southern New Mexico (*A. brachypterum* Woot. & Stanl.).

Sometimes planted as a shade-tree; the prevailing tree in the streets and squares of Raleigh, North Carolina.

8. Acer grandidentatum Nutt. Sugar Maple.

Leaves cordate or truncate at base, 3-lobed by broad shallow sinuses, the lobes acute or obtuse, entire or slightly lobulate, sparingly hairy on the upper surface and thickly coated

Fig. 624

with dense pale tomentum on the lower surface when they unfold, and at maturity thick and firm, dark green and lustrous above, pale and pubescent below, especially on the stout nerves and veins, or rarely glabrous, 2′–5′ in diameter; turning in the autumn before falling yellow and scarlet; petioles stout, 1′–2′ in length, glabrous, often red after midsummer, encircling the branchlet with their large base villose on the inner surface. **Flowers** appearing with the leaves on long slender drooping villose pedicels, in short-stalked corymbs; calyx campanulate, yellow, sparingly hairy with long pale hairs, about $\frac{1}{4}'$ long, with broad rounded lobes, often persistent under the fruit; corolla 0; stamens 7 or 8, much longer than the calyx, in the pistillate flower shorter than the calyx; ovary usually glabrous, with long spreading

stigmatic lobes, rudimentary in the staminate flower. **Fruit** often rose-colored at midsummer, green at maturity, glabrous or rarely sparingly hairy, with spreading or erect wings $\frac{1}{2}'$–$1'$ long; **seeds** smooth, light red-brown, about $\frac{1}{4}'$ long.

A tree, occasionally 30°–40° high, with a trunk 8′–10′ in diameter, stout usually erect branches, and slender glabrous bright red branchlets marked by numerous small pale lenticels and nearly encircled by the narrow leaf-scars, with conspicuous bands of long pale hairs in their axils. **Winter-buds** acute or acuminate, about $\frac{1}{10}'$ long, bright red-brown, with puberulous-ciliate outer scales and obovate apiculate inner scales sometimes $\frac{1}{2}'$ long when fully grown. **Bark** of the trunk thin, dark brown, separating on the surface into plate-like scales. **Wood** heavy, hard, close-grained, bright brown or nearly white, with thick sapwood.

Distribution. Banks of mountain streams usually at altitudes of 5000°–6000° above the sea; on the Salt River Mountains, western Wyoming; valley of the Columbia River in northern Montana, southeastern Idaho (Pocatello, Oneida County), Wasatch Mountains, Utah, mountains of Arizona and of southern New Mexico; on the Guadalupe Mountains, western Texas, and on the Wichita Mountains, southwestern Oklahoma (*G. W. Stevens*); in Coahuila; rare and local.

Occasionally cultivated; hardy in the Arnold Arboretum.

9. Acer nigrum Michx. Black Maple.

Leaves generally 3 or occasionally 5-lobed, with abruptly short-pointed acute or acuminate lobes, undulate and narrowed from broad shallow sinuses and rarely furnished with short lateral spreading lobules, cordate at base with a broad sinus usually more or less closed

Fig. 625

by the approximation or imbrication of the basal lobes, occasionally 3-lobed with a broad long-acuminate nearly entire terminal lobe, and rounded or slightly cordate at base (var. *Palmeri* Sarg.), covered below when they unfold with hoary tomentum and above with caducous pale hairs, and at maturity thick and firm in texture, dull green on the upper surface, yellow-green and soft-pubescent, especially along the yellow veins on the lower surface, and 5′–6′ long and wide, with drooping sides; turning bright clear yellow in the autumn; petioles stout, tomentose or pubescent, sometimes becoming glabrous at maturity, usually pendent, 3′–5′ in length, much enlarged at base, frequently nearly inclosing the buds, in falling leaving narrow scars almost encircling the branchlet and furnished in their axils with tufts of long pale hairs; stipules triangular and dentate or foliaceous, sessile or stipitate, oblong, acute, tomentose or pubescent, sometimes slightly lobed, frequently $1\frac{1}{2}'$ long. **Flowers** yellow, about $\frac{1}{4}'$ long, on slender hairy pedicels $2\frac{1}{2}'$–$3'$ long, in many-

flowered nearly sessile umbel-like corymbs, the staminate and pistillate in separate or in the same cluster on the same or on different trees; calyx broad-campanulate, 5-lobed by the partial union of the sepals, pilose on the outer surface near the base; corolla 0; stamens 7 or 8, with slender glabrous filaments, in the staminate flower nearly twice as long as the calyx and in the pistillate flower shorter than the calyx; ovary obtusely lobed, pale green, covered with long scattered hairs, minute in the sterile flower. **Fruit** glabrous, with convergent or wide-spreading wings $\frac{1}{2}'$–$1'$ long; **seeds** smooth, bright red-brown, $\frac{1}{4}'$ long.

A tree, sometimes 80° high, with a trunk frequently 3° in diameter, stout spreading or often erect branches, and stout branchlets marked by oblong pale lenticels, orange-green and pilose with scattered pale caducous hairs when they appear, orange or orange-brown and lustrous during their first year, becoming dull pale gray-brown the following season. **Winter-buds** sessile, ovoid, acute, $\frac{1}{8}'$ long, with dark red-brown acute scales hoary-pubescent on the outer surface and often slightly ciliate on the margins, and yellow puberulous inner scales, $\frac{1}{2}'$–$1'$ long at maturity. **Bark** of young stems and of the branches thin, smooth, pale gray, becoming on old trunks thick, deeply furrowed, and sometimes almost black.

Distribution. Valley of the St. Lawrence River in the neighborhood of Montreal, Quebec, southward to the valley of Cold River, New Hampshire, through western Vermont and Massachusetts and northwestern Connecticut (near Salisbury, Litchfield County), and westward through northern and western New York, southern Ontario, Ohio, the southern peninsula of Michigan, Indiana, Illinois, and Iowa to southeastern Minnesota, northeastern South Dakota, western and southern Missouri, eastern Kansas, and southward through western Pennsylvania, West Virginia and eastern Kentucky; comparatively rare near Montreal and in New England, more abundant farther west; almost entirely replacing *Acer saccharum* in Iowa, and the only Sugar Maple of South Dakota; easily distinguished in summer by its heavy drooping leaves, and at all seasons of the year by the orange color of the branchlets; the var. *Palmeri* in a single grove at Tunnel Hill, Johnson County, Illinois; southern Indiana (Shelby, Putnam and Lawrence Counties), and in Clark, Jackson and Dunklin Counties, Missouri; rare and local.

Occasionally planted in the region where it grows naturally as a shade-tree.

10. Acer leucoderme Small. Sugar Maple.

Leaves usually truncate or slightly cordate at base, more or less deeply divided into 3–5 acute caudate-acuminate lobes coarsely and sinuately dentate or undulate, when they unfold coated below with long matted pale caducous hairs, and at maturity thin, dark yellow-green above, bright yellow-green and pilose-pubescent below, $2'$–$3\frac{1}{2}'$ in diameter; often turning in the autumn bright scarlet on the upper surface before falling; petioles slender, glabrous, $1'$–$1\frac{1}{2}'$ in length. **Flowers** yellow, about $\frac{1}{8}'$ long, on slender, glabrous pedicels, in nearly sessile clusters; calyx campanulate, glabrous or slightly villose, with rounded ciliate lobes; corolla 0; stamens 7 or 8; filaments villose, longer than the calyx, much shorter than the calyx in the pistillate flower; ovary villose; style elongated, with short spreading lobes. **Fruit** villose, with long scattered pale hairs until nearly grown, becoming glabrous at maturity, the wings wide-spreading or divergent, $\frac{1}{2}'$–$\frac{3}{4}'$ long; **seeds** smooth, light red-brown, about $\frac{1}{4}'$ long.

A tree, usually 20°–25° high, with a trunk a foot in diameter, occasionally 40° high, with a trunk $18'$–$20'$ in diameter, short slender branches forming a rather compact round-topped head, and slender glabrous branchlets dark green when they first appear, becoming bright red-brown and lustrous during their first summer, and marked by numerous small oblong pale lenticels, gradually growing darker in their second year and finally light gray-green. **Winter-buds** ovoid, acute, dark brown, glabrous, rather more than $\frac{1}{16}'$ long, the inner scales becoming bright crimson and very conspicuous when the tree is in flower. **Bark** of young stems and large branches close, light gray or grayish brown, becoming near the base of old trees dark brown or often nearly black and broken by deep furrows into narrow ridges covered by closely appressed scales.

Distribution. Banks of streams, rocky gorges, and woods in moist soil; valley of the Yadkin River, Stanley County, North Carolina; southeastern Tennessee (Polk County); valley of the Savannah River (Abbeville County, South Carolina, and Richmond County,

Fig. 626

Georgia) to central and northwestern Georgia (near Rome, Floyd County, and Walker County) and to the valley of the Chattahoochee River to Muscogee County; northern and central Alabama; western Louisiana (Natchitoches and Sabine Parishes); southern Arkansas (Baker Springs, Howard County); rare and local; most abundant in northwestern and central Georgia and northern Alabama.

Occasionally planted as a street tree in the towns of northern Georgia and Alabama; hardy as far north as eastern Massachusetts.

11. Acer saccharinum L. Silver Maple. Soft Maple.

Leaves truncate or somewhat cordate at base, deeply 5-lobed by narrow sinuses, with acute irregularly and remotely dentate lobes, the middle lobe often 3-lobed, rarely laciniately divided (var. *Wieri* Schwerin), 6′–7′ long and nearly as broad, thin, bright pale green above, silvery white and at first slightly hairy below, especially in the axils of the primary veins; turning pale yellow in the autumn before falling; petioles slender, drooping, bright red, 4′–5′ in length. **Flowers** greenish yellow, opening during the first warm days of the late winter or early spring long before the appearance of the leaves, on short pedicels, in sessile axillary fascicles on shoots of the previous year, or on short spur-like branchlets developed the year before from wood of the preceding season, the staminate and pistillate in separate clusters, on the same or on different trees, and produced from clustered obtuse buds covered with thick ovate pubescent red and green scales ciliate on the margins with a thick fringe of long rufous hairs; calyx slightly 5-lobed, more or less pubescent on the outer surface, long and narrow in the staminate and short and broad in the pistillate flower; corolla 0; stamens 3–7, with slender filaments, three times as long as the calyx of the staminate flower and about as long as the calyx of the pistillate flower; ovary covered, like the young fruit, with a thick coat of pubescence, rudimentary in the sterile flower; styles united at base only, with long exserted stigmatic lobes. **Fruit** ripening in April and May when the leaves are nearly grown, on slender drooping pedicels, 1½′–2′ long, glabrous, 1½′ to nearly 3′ long, with thin almost straight conspicuously falcate divergent wings sometimes ¾′ broad, prominently reticulate-veined and pale chestnut-brown or rarely bright red; **seeds** ½′ long, with a pale reddish brown wrinkled coat, germinating as soon as they fall to the ground, and producing plants with several pairs of leaves before the end of the summer.

A tree, 90°–120° high, with a trunk 3°–4° in diameter, generally dividing 10°–15° from the ground into 3 or 4 stout upright secondary stems destitute of branches for a considerable length, brittle pendulous branchlets light green and covered with lenticels when they first appear, soon becoming darker, bright chestnut-brown, smooth and lustrous in the autumn and winter of their first year, and in their second season pale rose color or gray faintly tinged with red. **Winter-buds** $\frac{1}{8}'$ long, with thick ovate bright red outer scales rounded on the back, minutely apiculate, and ciliate on the margins, and acute inner scales pubescent on the inner surface, becoming pale green or yellow and about 1′ long. **Bark** of young stems and large branches smooth and gray faintly tinged with red, becoming on old trunks $\frac{1}{2}'$–$\frac{3}{4}'$ thick, reddish brown and more or less furrowed, the surface separating into large thin scales. **Wood** hard, strong, close-grained, easily worked, rather brittle,

Fig. 627

pale brown, with thick sapwood of 40–50 layers of annual growth; now sometimes used for flooring and in the manufacture of furniture. Sugar is occasionally made from the sap.

Distribution. Sandy banks of streams, rarely in deep often submerged swamps; valley of the St. John's River (near Fredericton), New Brunswick, to that of the St. Lawrence in Quebec, and southward through western Vermont and central Massachusetts to western Florida (valley of the Apalachicola River), Alabama, and south central Mississippi, and westward through Ontario, New York, Ohio, the southern peninsula of Michigan and southern Indiana to Minnesota, southeastern South Dakota, and eastern Nebraska, and through Kentucky, Tennessee, Missouri, eastern Kansas, northwestern Arkansas, and eastern Oklahoma; in western Louisiana (swamp near Alexandria, Rapides Parish); rare in the immediate neighborhood of the Atlantic coast and on the high Appalachian Mountains; probably of its largest size in the valley of the lower Ohio River.

Often cultivated with several forms differing in habit and in the lobing of the leaves; fast-growing, and largely planted in the eastern states as a park and street tree.

12. Acer rubrum L. Red Maple. Scarlet Maple.

Leaves truncate, more or less cordate by a broad shallow sinus, rounded or cuneate at base, 3–5-lobed by acute sinuses, with irregularly doubly serrate or toothed lobes, the middle lobe often longer than the others, when they unfold pubescent especially beneath, and at maturity light green and glabrous on the upper surface and white or glaucescent and more or less pubescent or densely tomentose (var. *tomentosum* Kirch. [var. *rubrocarpum* Detmars]) on the lower surface, particularly along the principal veins, chartaceous or sometimes almost coriaceous, $1\frac{1}{2}'$–6′ long and rather longer than broad; turning in the early

autumn to brilliant shades of scarlet and orange, or clear bright yellow; petioles slender, glabrous or puberulous, red or green, 2′–4′ in length. Flowers opening in March and April before the appearance of the leaves, bright scarlet, dull yellowish red or sometimes yellow (var. *pallidiflorum* Pax.), on long slender pedicels, in few-flowered fascicles on branches of the previous year, from clustered obtuse buds, the staminate and pistillate flowers in separate clusters on the same or on different trees; sepals oblong, obtuse, as long as and broader than the oblong or linear petals; stamens 5–8, scarlet or yellow, with slender filaments exserted in the staminate and included in the pistillate flower; ovary glabrous on a narrow slightly lobed glandular disk; styles slightly united above the base, with long exserted stigmatic lobes. Fruit ripening in the spring or early summer on drooping stems 3′–4′ long, scarlet, dark red or brown or yellow, with thin erect wings, convergent at first, divergent at ma-

Fig. 628

turity, ½′–1′ long and ¼′–½′ wide; seeds dark red, with a rugose coat, ¼′ long, germinating as soon as it falls to the ground.

A tree, 80°–120° high, with a tall trunk 3°–4½° in diameter, upright branches usually forming a rather narrow head, and branchlets green or dark red when they first appear, becoming dark or bright red and lustrous at the end of their first summer and marked by numerous longitudinal white lenticels, and gray faintly tinged with red in their second year. Winter-buds obtuse, ⅛′ long, with thick dark red outer scales, rounded on the back and ciliate on the margins, and inner scales becoming ¾′–1′ long, narrow-oblong, rounded at apex and bright scarlet. Bark of young stems and of the branches smooth and light gray, becoming on old trunks ¼′–½′ thick, dark gray, and divided by longitudinal ridges separating on the surface into large plate-like scales. Wood very heavy, close-grained, not strong, light brown often slightly tinged with red, with thick rather lighter colored sapwood; used in large quantities in the manufacture of chairs and other furniture, in turnery, for wooden ware and gun-stocks. A form of fastigiate habit (var. *columnare* Rehd.) is occasionally cultivated.

Distribution. Borders of streams, wet swamps, upland forests and rarely on dry rocky hillsides and sand dunes; Newfoundland, southward to southern Florida (near the neighborhood of Fort Lauderdale, Broward County, *R. M. Harper*) and westward through Quebec to latitude 49° north, and Ontario to the sandy shores of the Upper Peninsula of Michigan (Brevort, Mackinac County, on Lake Michigan and White Fish Point, Chippewa County, on Lake Superior), western Wisconsin, northwestern Minnesota (Buckeye County), southeastern Iowa (Johnson County), central Oklahoma, and the valley of the Trinity River, Texas; on the mountains of North Carolina to altitudes of 4500°; one of the commonest and most generally distributed trees of eastern North America, ranging between more degrees

of latitude than any other American tree; most abundant southward especially in the valley of the Mississippi River, and of its largest size in the river swamps of the lower Ohio and its tributaries; in the north often covering with small trees low wet swamps; on the sand dunes and ridges of northern Michigan reduced to a low shrub. On var. *tomentosum* leaves usually 5-lobed, cordate or rarely rounded at base, with glabrous or pubescent petioles and branchlets; widely distributed but rare; near Cranberry Island, Buckeye Lake, Licking County, Ohio, Biltmore, Buncombe County, North Carolina; neighborhood of Augusta, Richmond County, Georgia; top of Flagstaff Mountain, Barclay, Talladega County, Alabama; Panther Burn, Sharkey County, Mississippi; Crawford and Duvois Counties, Indiana, near Olney, Rutland County, and in Richland, Wayne and Johnson Counties, Illinois; near Little Rock, Pulaski County, Arkansas; near Page, Leflore County, Oklahoma, and Larissa, Cherokee County, Texas; connected by trees of this variety with pubescent branchlets and winter-buds, and broad-ovate 3–5-lobed slightly cordate leaves and pubescent petioles with

Acer rubrum var. Drummondii Sarg.

Leaves often broader than long, usually 5-lobed, cordate or truncate at base, 3′–6′ long and wide, with a stout midrib and veins, until nearly fully grown covered above with scattered hairs and clothed below with thick snow-white tomentum, and more or less pubescent

Fig. 629

during the season; petioles stout, hoary-tomentose, $1\frac{1}{4}'$–4′ in length, becoming nearly glabrous in the autumn. **Flowers** bright scarlet. **Fruit** ripening with or before the unfolding of the leaves late in March or in April, bright scarlet, with convergent wings $1\frac{1}{4}'$–$2\frac{1}{2}'$ long and $\frac{1}{2}'$–$\frac{3}{4}'$ wide.

A tree, usually not more than 30°–35° high, with small erect branches forming a narrow head and slender branchlets coated when they first appear with matted pale hairs, becoming glabrous and dark reddish brown in their second season.

Distribution. Deep swamps, eastern Louisiana to the valley of the Neches River (Beaumont, Jefferson County, and Concord, Hardin County), eastern Texas and northward through southern and eastern Arkansas to western Mississippi, western Tennessee and Kentucky, southeastern Missouri (Butler, Stoddard, Dunklin and Mississippi Counties), southern Illinois (Gallatin, Pulaski and Richland Counties), and southwestern Indiana (swamp eighteen miles west of Decker, Knox County, *C. C. Deam*). A form growing at Hattiesburg, Forrest County, Mississippi, at Glen Gordon, Covington, St. Tammany Parish, and Chopin, Natchitoches Parish, Louisiana, near Beaumont, Jefferson County, Texas, and at Poplar Bluff, Butler County, Missouri, with 3-lobed leaves rounded at base (f. *rotundatum* Sarg.) shows in the shape of the leaves a transition from the var. *Drummondii* to

Acer rubrum var. tridens Wood. Red Maple.

Acer carolinianum Britt. not Walt.

Leaves obovate, usually narrowed from above the middle to the rounded or rarely cuneate base, 3-lobed at apex, with acute or acuminate erect or slightly spreading lobes, simple or furnished with short lateral secondary lobes, remotely serrate except toward the base, with

Fig. 630

incurved glandular teeth, and often ovate by the suppression of the lateral lobes and acute or acuminate, thick and firm in texture, glaucous and usually pubescent or rarely tomentose or tomentulose below, 2′–3′ long and 1½′–2½′ wide; petioles slender, glabrous or pubescent. **Flowers** sometimes tawny yellow. **Fruit** usually much smaller and rarely also yellow.

Distribution. Usually with the species; Massachusetts and central New York, southward usually in the coast region and the middle districts to western Florida, along the Gulf coast to the valley of the Trinity River, Texas, and through western Louisiana, and Arkansas to northeastern Mississippi, southern Missouri, Arkansas, western Tennessee and Kentucky and southern Illinois; in North Carolina occasionally ascending on the Appalachian Mountains to altitudes of 3000°; often the prevailing Red Maple in southern Missouri and northwestern Louisiana; in the swamps of western Florida and southwestern Georgia the form with leaves densely tomentose below and pubescent petioles prevails.

13. Acer Negundo L. Box Elder. Ash-leaved Maple.

Leaves usually 3, rarely 5–7-foliolate, with a slender glabrous petiole 2′–3′ in length, the enlarged base often furnished with a minute rim of deciduous white hairs, and in falling leaving a large conspicuous scar surrounding the stem; leaflets ovate to elliptic or obovate, acuminate, and often long-pointed at apex, rounded or cuneate and often unsymmetrical at base, coarsely and irregularly serrate usually only above the middle or nearly entire, and occasionally slightly and irregularly lobulate; when they unfold more or less hoary-tomentose below and slightly pubescent above, and at maturity thin, light green, paler on the lower than on the upper surface, glabrous above, villose-pubescent along the under side of the midrib and veins, often furnished with conspicuous tufts of axillary hairs, otherwise glabrous or slightly pubescent below, 2½′–4′ long, and 1½′–2½′ wide, on slender glabrous petiolules, that of the terminal leaflet ¾′–1′ long and much longer than those of the smaller lateral leaflets. **Flowers** on slender glabrous or rarely hairy pedicels, minute, apetalous, yellow-green, the staminate and pistillate on separate trees, expanding just before or with the leaves from buds developed in the axils of the last leaves of the previous year, the staminate fascicled, the pistillate in narrow drooping racemes, sometimes furnished near the

base with one or two smaller 3-lobed or rarely elliptic leaves; calyx 5-lobed, hairy, campanulate in the staminate flower, much smaller in the pistillate flower and divided to the base into 5 narrow sepals; corolla 0; stamens 4–6, with slender exserted hairy filaments and long linear anthers narrowed and apiculate at apex, 0 in the pistillate flower; ovary on a narrow rudimentary disk, pubescent, only partly inclosed by the calyx; style separating from the base into 2 long stigmatic lobes. **Fruit** attaining nearly its full size in summer, pendent on glabrous stems 1′–2′ long, in graceful racemes 6′–8′ in length, ripening in the autumn, deciduous from the stems persistent on the branches until the following spring, $1\frac{1}{2}$′–2′ long, with narrow acute pubescent nutlets diverging at an acute angle and constricted below into a stipe-like base, and thin reticulate straight or falcate wings undulate toward the apex; **seeds** narrowed at the ends, smooth, bright red-brown, $\frac{1}{2}$′ long.

Fig. 631

A tree 50°–70° high, with a trunk 2°–4° in diameter, dividing near the ground into a number of stout wide-spreading or erect branches, and slender pale green lustrous glabrous branchlets. **Winter-buds** terminal acute, $\frac{1}{8}$′ long, rather longer than the obtuse lateral buds, the scales tomentose, those of the inner pairs accrescent, becoming 1′ long at maturity, deciduous, leaving conspicuous scars visible at the base of the branchlet for two or three years. **Bark** of the trunk $\frac{1}{4}$′–$\frac{1}{2}$′ thick, pale gray or light brown and deeply divided into broad rounded ridges separating on the surface into short thick scales. **Wood** light, soft, close-grained, not strong, creamy white, with thick hardly distinguishable sapwood; occasionally manufactured into cheap furniture, and sometimes used for the interior finish of houses, for wooden ware, cooperage, and paper pulp. Small quantities of maple sugar are occasionally made from this tree.

Distribution. Banks of streams and lakes, and the borders of swamps; western Vermont, western Massachusetts and Connecticut, central New York and southwestern Ontario, and southward to west-central Florida (Hernando County) and westward to Minnesota, Iowa, Nebraska, Missouri, eastern Kansas, Arkansas, eastern Oklahoma, western Louisiana, and eastern and southern Texas to the valley of the lower Rio Blanco.

Often planted in the United States, especially in the western states and in eastern Canada, and in western and northern Europe, especially the varieties with variegated leaves.

Passing into the following varieties:

Var. **violaceum** Kirch., with slender pale or bluish violet glabrous branchlets covered with a glaucous bloom and rather larger winter-buds. **Leaves** 3–11, usually 3–7-foliolulate, the leaflets slightly thicker, lanceolate to oblong-ovate or obovate, often entire or irregularly dentate, occasionally lobed, the terminal leaflet sometimes 3-lobed, usually pubescent and furnished with tufts of axillary hairs on the lower surface. **Fruit** glabrous,

usually constricted at the base. Western Massachusetts through Ohio to northern Wisconsin, Minnesota, Iowa and South Dakota, and to northern and southwestern Missouri; in Nez Perces County, Idaho.

Var. **texanum** Pax., with branchlets covered with pale tomentum. **Leaves** 3-foliate, the leaflets ovate, or the terminal obovate, acuminate, short-pointed at apex, rounded or cuneate at base, coarsely serrate above the middle or entire, only slightly and irregularly lobed, early in the season villose along the midrib and veins above and thickly coated below with matted pale hairs, and at maturity nearly glabrous on the upper surface and covered below with loose pubescence, 3′–4′ long and 2′–3′ wide. **Fruit** puberulous, constricted into a short stipe-like base. Western and southwestern Missouri, southeastern Kansas, Arkansas, Oklahoma and eastern Texas to the valley of the San Antonio River. Passing into forma *latifolia* Sarg. differing only in its glabrous branchlets, and distributed from eastern Texas through Louisiana to western Mississippi, western North Carolina, Virginia and southern Ohio.

Var. **interior** Sarg., with branchlets covered with close pale pubescence, or rarely nearly glabrous. **Leaves** trifoliate, with puberulous petioles, rachis and petiolules, the long-stalked leaflets ovate to lanceolate, or the terminal sometimes obovate, acuminate and long-pointed at apex, cuneate, rounded or cordate at base, coarsely serrate, sometimes distinctly 3-lobed at base, glabrous or villose on the midrib below, or in Arizona sometimes sparingly pubescent on the lower surface, 3′–4′ long and 1½–4′ wide. **Fruit** glabrous, not at all, slightly or at the north conspicuously constricted at the base. Southern Manitoba, Saskatchewan and Alberta to Wyoming, and through the mountain regions of Colorado and Utah to New Mexico and Arizona.

Var. **arizonicum** Sarg., with glabrous branchlets thickly covered with a glaucous bloom. **Leaves** thin, 3-foliolulate; petioles slender, glabrous, 1¾′–3′ long, often turning bright red late in summer; leaflets oblong-ovate to rhombic, acuminate and long-pointed at apex, rounded or cuneate at base, coarsely serrate, often slightly lobed near the middle, glabrous with the exception of conspicuous tufts of axillary hairs, 2½′–4′ long, 1½′–2′ wide; petiolules slender, glabrous, usually bright red, that of the terminal leaflet ¾′–1′ long, the others not more than ⅛′ in length. **Fruit** in glabrous racemes 3′ or 4′ long, the body glabrous, spreading, not constricted at base. A tree, 20°–25° high. **Bark** fissured. Mountain cañons, central and southern Arizona up to 8000° altitude, and in Socorro County, New Mexico. More distinct is

Acer Negundo var. californicum Sarg.

Leaves trifoliate with tomentose or nearly glabrous rachis and petiolules; leaflets oblong-ovate to rhombic, acuminate and long-pointed at apex, cuneate or unsymmetrically

Fig. 632

rounded at base, coarsely serrate above the middle, or nearly entire, when they unfold hoary-tomentose below and densely pubescent above, occasionally deeply lobed, glabrous on the upper surface except along the midrib and veins, thickly coated on the lower surface with matted pale hairs and furnished with large axillary tufts. Fruit on pubescent pedicels, puberulous or nearly glabrous, not constricted or rarely slightly constricted at base.

A tree, 20°–50° high, with dark bark, hoary-tomentose branchlets and winter-buds.

Distribution. California, valley of the lower Sacramento River and the interior valleys of the coast ranges from the Bay of San Francisco to Santa Barbara County and in elevated cañons on the western slopes of the San Bernardino Mountains; widely distributed but nowhere abundant.

Occasionally planted in California.

XXXVI. HIPPOCASTANACEÆ.

Trees or rarely shrubs, with stout terete branchlets conspicuously marked by triangular leaf-scars, fetid bark, thick fleshy roots, and large scaly winter-buds, the inner scales accrescent with the young shoots and often brightly colored. Leaves opposite, digitately compound, without stipules, deciduous; leaflets 3–9, lanceolate or ovate, serrate, pinnately veined. Flowers polygamo-monœcious, showy, white, red, or pale yellow, on stout jointed pedicels from the axils of minute caducous bracts, racemose or nearly unilateral on the branches of large terminal thyrsi or panicles, appearing later than the leaves, only those near the base of the branches of the inflorescence perfect and fertile; calyx 5 or rarely 2-lobed, the lobes imbricated in the bud, unequal, campanulate or tubular, the lobes imbricated in the bud, mostly oblique or posteriorly gibbous at base; disk hypogynous, annular, depressed, lobed, more or less gibbous posteriorly; petals 4 or 5, imbricated in the bud, alternate with the lobes of the calyx, deciduous, the anterior petal often abortive, unguiculate, the margins of the claw commonly involute; stamens 6–8, rarely 5, generally 7, inserted on the disk, free, unequal; filaments filiform; anthers ellipsoid, glandular-apiculate, attached on the back below the middle, introrse, 2-celled, the contiguous cells opening longitudinally; ovary sessile, oblong or lanceolate, 3-celled, echinate or glabrous, rudimentary in the staminate flower; style slender, elongated, generally more or less curved; stigma terminal, entire, mostly acute; ovules 2 in each cell, borne on the middle of its inner angle, amphitropous, the upper ascending, the micropyle inferior, the lower pendulous, the micropyle superior. Fruit an echinate or smooth coriaceous capsule, 3-celled and loculicidally 3-valved, the cells 1-seeded by abortion, often by suppression 1 or 2-celled, and then 1 or 2-seeded, the remnants of the abortive cells and seeds commonly visible at its maturity. Seeds without albumen, round when one is developed, or, when more than one, flattened by mutual pressure; seed-coat coriaceous, dark chestnut-brown or pale orange-brown, smooth and lustrous, with a broad opaque light-colored hilum; embryo filling the cavity of the seed; cotyledons very thick and fleshy, often conferruminate, unequal, incurved on the short conic radicle, remaining under ground in germination; plumule conspicuously 2-leaved.

The Horsechestnut family is composed of the widely distributed genus Aesculus and of Billia Peyr., a genus of two species of Mexican and Central American trees, differing from Aesculus in its 3-foliolate leaves.

1. AESCULUS L.

Characters of the family; leaves 5–9-foliolate.

Aesculus with fifteen or sixteen species is represented in the floras of the three continents of the northern hemisphere and is most abundant in the southeastern United States. It produces soft straight-grained light-colored wood and bitter and astringent bark. The seeds contain a bitter principle, aesculin. *Aesculus Hippocastanum* L., of the mountains

of Greece, the common Horsechestnut of gardens, is largely planted as an ornamental tree in all countries with temperate climates, and now occasionally grows spontaneously in the eastern states.

The generic name is the classical name of an Oak-tree.

CONSPECTUS OF THE ARBORESCENT SPECIES OF NORTH AMERICA.

Winter-buds without a resinous covering. PAVIA.
- Calyx campanulate (*occasionally tubular in 3*); margins of the petals ciliate, eglandular; flowers usually yellow. OCTANDRÆ.
  - Fruit covered with prickles; flowers yellow; petals nearly equal in length, shorter than the stamens. **1. A. glabra** (A, C).
  - Fruit without prickles; flowers yellow or red; petals unequal in length, longer than the stamens.
    - Pedicels and calyx glandular-villose. **2. A. octandra** (A, C).
    - Pedicels and calyx without glandular hairs. **3. A. georgiana** (C).
- Calyx tubular; margins of the unequal petals without hairs, glandular; fruit without prickles. EUPAVIÆ.
  - Lower surface of the leaves glabrous or slightly pubescent along the midrib; flowers red; seeds dark chestnut-brown. **4. A. Pavia** (C).
  - Lower surface of the leaves tomentose or pubescent; flowers red and yellow, red, or in one form yellow; seed light yellow-brown. **5. A. discolor** (C).

Winter-buds resinous; petals nearly equal in length, shorter than the stamens; fruit without prickles. CALOTHYRSUS. **6. A. californica** (G).

1. Aesculus glabra Willd. Ohio Buckeye. Fetid Buckeye.

Leaves with a slender petiole 4′–6′ long and enlarged at the end, a rachis often furnished on the upper side with clusters of dark brown chaff-like scales surrounding the base of the petiolules, and 5 rarely 7 (var. *Buckleyi* Sarg.) oval-oblong or obovate acuminate leaflets

Fig. 633

gradually narrowed to the elongated entire base, finely and unequally serrate above, at first sessile, becoming slightly petiolulate at maturity, covered on the lower surface like the petioles when they first appear with floccose deciduous hairs most abundant on the midrib and veins, and at maturity glabrous with the exception of a few hairs along the under side of the conspicuous yellow midrib and in the axils of the principal veins, or rarely covered below with close dense pubescence persistent during the season (var. *pallida*, Kirch.), yellow-green, paler on the lower than on the upper surface, 4′–6′ long and 1½′–2½′ wide; turning

yellow in the autumn before falling. **Flowers** pale yellow-green, mostly unilateral, ½′–1½′ long or more than twice as long as the pedicels, appearing in April and May in clusters 5′–6′ long and 2′–3′ wide, and more or less densely covered with pubescence, with short usually 4–6-flowered branches; calyx campanulate; petals nearly equal, puberulous, the thin limb about twice as long as the claw, in the lateral pair broad-ovate or oblong, and in the superior pair oblong-spatulate, much narrower, sometimes marked with red stripes; stamens usually 7, with long exserted curved pubescent filaments and orange-colored slightly hairy anthers; ovary pubescent, covered with long slender deciduous prickles thickened and tubercle-like at base. **Fruit** on a stout stem ½′–1′ long, ovoid or irregularly obovoid, pale brown, 1′–2′ long, with thin or sometimes thick valves, roughened by the enlarged persistent bases of the prickles of the ovary; **seeds** 1′–1½′ broad.

A tree, occasionally 70° high, with a trunk rarely 2° in diameter, small spreading branches, and branchlets orange-brown and covered at first with short fine pubescence, soon glabrous, reddish brown, and marked by scattered orange-colored lenticels; usually much smaller, and rarely more than 30° high. **Winter-buds** ⅔′ long, acuminate, with thin nearly triangular pale brown scales, the outer bright red on the inner surface toward the base, those of the inner pair strap-shaped, prominently keeled on the back, minutely apiculate and slightly ciliate along the margins, and at maturity 1½′–2′ long and bright yellow. **Bark** of young stems and of the branches dark brown and scaly, becoming on old trees ¾′ thick, ashy gray, densely furrowed, and broken into thick plates roughened on the surface by numerous small scales. **Wood** light, soft, close-grained, not strong, often blemished by dark lines of decay, nearly white, with thin dark-colored sapwood of 10–12 layers of annual growth; used in the manufacture of artificial limbs, wooden ware, wooden hats, and paper pulp; occasionally sawed into lumber. An extract of the bark has been used as an irritant of the cerebro-spinal system.

Distribution. River-bottoms and the banks of streams in rich moist soil; western slopes of the Alleghany Mountains, western and southwestern Pennsylvania to northern Alabama, and westward to central and southern Iowa, southeastern Nebraska, northern and central Missouri and northeastern Kansas; nowhere abundant; most common and of its largest size in the valley of the Tennessee River in Tennessee and northern Alabama.

A shrubby form (var. *micrantha* Sarg.) with flowers not more than ½′ long near Fulton, Hempstead County, Arkansas. In southern Missouri, Arkansas and probably Oklahoma *Aesculus glabra* is replaced by the var. *leucodermis* Sarg. with glabrous leaves pale green or glaucescent below. A tree occasionally 60° high, well distinguished from the type by the smooth pale nearly white bark of the trunk and large branches, becoming on old trunks light brown and separating into oblong flakes, and by its later flowers; the var. *pallida* in Iowa, Missouri and Arkansas; the var. *Buckleyi* in Jackson County, Missouri, eastern Kansas, Ohio and Mississippi.

The Ohio Buckeye is occasionally cultivated as an ornamental plant in the eastern United States and Europe; hardy as far north as eastern Massachusetts.

× *Aesculus Bushii* Schn., probably a hybrid of *Aesculus discolor* var. *mollis* Sarg. and *Aesculus glabra* var. *leucodermis* Sarg., has been found in the neighborhood of Fulton, Hempstead County, Arkansas; and what is evidently a hybrid of *Aesculus discolor* var. *mollis* and the typical form of *Aesculus glabra* occurs near Starkville, Oktibbeha County, Mississippi.

× *Aesculus mississippiensis* Sarg., a probable hybrid between *Aesculus glabra* and *Aesculus Pavia* with characters intermediate between those of its supposed parents, occurs near Brookville, Noxubee County, Mississippi. The mingling of a species of the Octandræ and of the Eupaviæ in these hybrids of Aesculus is shown by the presence of both hairs and glands on the margins of the petals.

2. Aesculus octandra Marsh. Sweet Buckeye.

Leaves with slender or slightly pubescent petioles 4′–6′ long, and 5–7 elliptic or obovate-oblong leaflets, acuminate and usually abruptly long-pointed at apex, gradually narrowed and cuneate at base, sharply and equally serrate, glabrous above except on the midrib and

veins sometimes clothed with reddish brown pubescence, when they unfold more or less canescent-pubescent on the lower surface, becoming glabrous at maturity, with the exception of a few pale or rufous hairs along the stout midrib and in the axils of the principal veins, dark yellow-green, duller on the lower than on the upper surface, 4′–6′ long, and $1\frac{1}{2}$′–$2\frac{1}{2}$′ wide; petiolules $\frac{1}{2}$′–$\frac{1}{2}$′ in length; turning yellow in the autumn before falling. **Flowers** opening in early spring when the leaves are about half grown, 1′–$1\frac{1}{2}$′ long, pale or dark yellow, rarely red, pink or cream-colored (var. *virginica* Sarg.), on short glandular-villose pedicels mostly unilateral on the branches of the pubescent clusters 5′–7′ in length; calyx campanulate, glandular-villose; petals connivent, very unequal, puberulent, the claws villose within, limb of the superior pair spatulate, minute, the long claws exceeding the lobes of the calyx, those of the lateral pair obovate or nearly round and subcordate at base; stamens usually 7, rather shorter than the petals, with straight or inclining subulate villose filaments; ovary pubescent. **Fruit** 2′–3′ long, generally 2-seeded, with thin smooth or slightly pitted pale brown valves; **seeds** $1\frac{1}{2}$′ to nearly 2′ wide.

Fig. 634

A tree, sometimes 90° high, with a tall straight trunk $2\frac{1}{2}$°–3° in diameter, small rather pendulous branches, and glabrous or nearly glabrous branchlets orange-brown when they first appear, becoming in their second year pale brown and marked by numerous irregularly developed lenticels. **Winter-buds** $\frac{2}{3}$′ long, rather obtuse, with broad-ovate pale brown outer scales rounded on the back, minutely apiculate, ciliate, and slightly covered with a glaucous bloom, the inner scales becoming sometimes 2′ long, bright yellow or occasionally scarlet. **Bark** of the trunk about $\frac{3}{4}$′ thick, dark brown, divided by shallow fissures and separating on the surface into small thin scales. **Wood** light, soft, close-grained, difficult to split, creamy white, with thick hardly distinguishable sapwood; used in the manufacture of artificial limbs, for wooden ware, wooden hats, paper pulp, and occasionally sawed into lumber.

Distribution. Rich river-bottoms and mountain slopes; southwestern Pennsylvania (Alleghany, Greene and Fayette Counties), southward along the mountains to east Tennessee, and northwestern Georgia, and westward to north central Ohio (near Plymouth, Richard County), southeastern and southern Indiana (near Aurora, Dearborn County, and on the banks of Dry River near Leavenworth, Crawford County, *C. C. Deam*) and to southern Illinois (near Golconda, Pope County, shrub 6′–12′ high, *E. J. Palmer*); the var. *virginica* at White Sulphur Springs, West Virginia.

Occasionally cultivated in the parks of the eastern United States and Europe.

× *Aesculus hybrida* DC., with red and yellow flowers, believed to be a hybrid of *Aesculus octandra* and *Aesculus Pavia*, appeared in the Botanic Garden at Montpelier in France

early in the nineteenth century, and in many varieties is cultivated in Europe and occasionally in the eastern United States.

3. Aesculus georgiana Sarg.

Leaves with slender glabrous petioles $4\frac{1}{2}'$–$6'$ in length, and 5 leaflets oblong-obovate, abruptly acuminate and long-pointed at apex, gradually narrowed and acuminate at base, finely often doubly serrate with rounded teeth pointing forward, sparingly covered early in the season, especially on the upper side of the midrib and veins, with short caducous hairs, yellow-green above, green, glabrous and lustrous or pubescent (var. *pubescens* Sarg.) below, $4\frac{1}{2}'$–$6'$ long, $1\frac{1}{2}'$–$2\frac{1}{2}'$ wide, with a stout orange-colored midrib and 20–30 pairs of slender primary veins; petiolules stout, puberulous early in the season, $\frac{1}{4}'$–$\frac{1}{2}'$ in length. **Flowers**

Fig. 635

opening in April and May $1'$–$1\frac{1}{8}'$ long, on slender puberulous pedicels, in broad pubescent panicles, $4'$–$6'$ in length; calyx campanulate or tubular, puberulous, about $\frac{5}{12}'$ in diameter, red on the upper side, pale yellow on the lower side or entirely red or yellow, 5-lobed, the lobes oblong-ovate, narrowed and rounded at apex, finely serrate on the margins; petals connivent, obovate, rounded at apex, gradually narrowed below, those of the superior and lateral pairs very unequal in size, puberulous and glandular on the outer surface, pubescent on the inner surface, ciliate on the margins, bright yellow or red, their claws furnished on the margins with long white hairs, those of the superior pair as long as the lateral petals; stamens 7, shorter than the petals; filaments villose, especially below the middle; ovary covered with matted pale hairs; styles exserted, villose. **Fruit** on stout pendulous pedicels, globose, usually 1-seeded, $1'$–$1\frac{1}{4}'$ in diameter, with thin light brown slightly pitted valves; seed globose, dark chestnut-brown.

A tree, 25°–30° high, with a trunk $6'$–$10'$ in diameter, slender erect and spreading branches and stout glabrous branchlets, orange-green and marked by pale lenticels when they first appear, becoming light reddish brown in their first winter; more often a large or small round-topped shrub 3°–5° tall and broad. Bark of the trunk thin, dark brown, the surface separating into small thin scales. **Winter-buds** about $\frac{1}{3}'$ long, with light reddish

brown scales, narrowed, rounded and short-pointed at apex. The common Buckeye of the Piedmont region of North and South Carolina and northern Georgia.

Distribution. Central North Carolina (Durham and Orange Counties), southward to eastern (Richmond County) and central Georgia; northern Alabama (Madison, Etowah and Tuscaloosa Counties), and near Pensacola, Escambia County, Florida. The var. *pubescens* occasionally arborescent in habit, common in the woods west of Augusta, Richmond County, and in De Kalb, Rabun and Floyd Counties, Georgia, ranging northward to Orange County, North Carolina, and ascending on the Blue Ridge to altitudes of 3000°; in northern Alabama.

× *Aesculus Harbisonii* Sarg., a probable hybrid between *A. discolor* var. *mollis* and *A. georgiana*, has appeared in the Arnold Arboretum among plants of *A. georgiana* raised from seeds collected near Stone Mountain, De Kalb County, Georgia.

A distinct form of *Aesculus georgiana* is

Aesculus georgiana var. lanceolata Sarg.

Leaves with glabrous petioles $3\frac{1}{2}'$–$5\frac{1}{2}'$ in length, and 5 lanceolate or slightly oblanceolate leaflets long-acuminate at apex, cuneate at base, and finely glandular-serrate, when the

Fig. 636

flowers open early in May thin yellow-green above, pale below, glabrous with the exception of occasional hairs on the under side of the slender midrib and of minute axillary tufts, 6′–8′ long and $1\frac{1}{4}'$–$1\frac{1}{2}'$ wide; petiolules $\frac{1}{12}'$–$\frac{1}{6}'$ in length. **Flowers** on stout puberulous pedicels, bright red, in narrow crowded clusters, 8′–10′ long; calyx narrow-campanulate, otherwise as in the type. **Fruit** not seen.

A tree 25°–30° high, with a short trunk 6′–10′ in diameter, small erect and spreading branches forming a narrow head, and slender glabrous branchlets orange-brown when they first appear, becoming dark gray-brown and marked by pale lenticels in their second year.

Distribution. Georgia, rich woods near Clayton, Rabun County.

4. Aesculus Pavia L. Red-flowered Buckeye.

Leaves with slender petioles glabrous or puberulous early in the season and 4′–7′ long, and 5 short-petiolulate, oblong-obovate, acuminate leaflets, gradually narrowed at base,

coarsely often doubly serrate above with incurved teeth, slightly pubescent early in the season along the upper side of the midrib and veins, and glabrous or slightly pubescent below, and at maturity thin, lustrous and glabrous, dark green on the upper surface, pale yellow-green on the lower surface, often furnished with conspicuous tufts of axillary hairs, $3\frac{1}{2}'$–$6'$ long and $1\frac{1}{4}'$–$1\frac{3}{4}'$ wide, with a thin midrib and from 18–30 pairs of slender primary veins. **Flowers** in narrow pubescent panicles, $4\frac{1}{2}'$–$8'$ in length, on slender pubescent pedicels; calyx tubular, dark red, puberulous on both surfaces, minutely lobed, the lobes rounded, much shorter than the light red petals; petals connivent, unequal, oblong-obovate,

Fig. 637

rounded at apex, glandular on the outer surface and on the margins, gradually narrowed below into a long slender villose claw; claw of the lateral petals about as long or shorter than the calyx, those of the superior pair much longer than the calyx, their blades not more than one-third as large as the blades of the lateral pair; stamens exserted; filaments villose like the ovary. **Fruit** obovoid or subglobose, light brown, smooth, generally pitted, usually 1 or 2-seeded, pendulous on slender stems; **seeds** usually about $1'$ in diameter, dark chestnut-brown and lustrous with a small hilum.

Occasionally a tree, rarely 40° high, with a tall trunk $8'$–$10'$ in diameter covered with smooth dark bark, large erect branches forming an open head, and stout light orange-brown branchlets marked in their second year by conspicuous emarginate scars of fallen leaves showing the ends of 3 fibro-vascular bundles; usually a shrub, often flowering when not more than $3'$ high.

Distribution. Southeastern Virginia, southward to middle Florida to the valley of the Suwannee River (near Old Town, Dixie County), and westward to eastern Louisiana, usually in the neighborhood of the coast; in Alabama ranging inland to Jefferson and Dallas Counties and in Louisiana to West Feliciana Parish; in southern Kentucky (near Bowling Green, Warren County).

5. Aesculus discolor Pursh. Buckeye.

Leaves with slender grooved villose or pubescent usually ultimately glabrous petioles 4′ or 5′ long, and 5 oblong-obovate or elliptic leaflets, acuminate and usually long-pointed at apex, gradually narrowed and acuminate at the entire base, finely or coarsely and sometimes doubly crenulate-serrate above, dark green, lustrous and glabrous except along the slender yellow midrib and veins on the upper surface, lighter colored and tomentulose or tomentose on the lower surface, 4′–5′ long, 1½′–2′ wide, nearly sessile or raised on slender petiolules up to ½′ in length. **Flowers** opening from the first to the middle of April, usually ¾′–1′ long, on slender pubescent pedicels much thickened on the fruit, sometimes ¼′ long, and mostly aggregated toward the end of the short branches of the narrow pubescent inflorescence 6′–8′ in length; calyx red, rose color or yellow more or less deeply tinged with

Fig. 638

red, tubular, short and broad or elongated, puberulous on the outer surface, tomentose on the inner surface, with rounded lobes; petals yellow, shorter than the stamens, connivent, unequal, oblong-obovate, rounded at apex, puberulous on the outer surface and glandular on the margins with minute dark glands, those of the superior pair about half as wide as those of the lateral pair, with claws much longer than the calyx; filaments and ovary villose. **Fruit** ripening and falling in October, usually only a few fruits maturing in a cluster, generally obovoid or occasionally subglobose, mostly 2-seeded, 1½′–2½′ long, with very thin, light brown slightly pitted valves; **seeds** light yellow-brown, sometimes 1½′ in diameter, with a comparatively small hilum and a thin shell.

Rarely arborescent and occasionally 25° high, with a straight trunk 6′ or 7′ in diameter, stout branches forming a narrow symmetric head, and slender branchlets marked by numerous small pale lenticels, green and puberulous at first, becoming gray slightly tinged with red during their first winter and only slightly darker in their second year; usually a small or large shrub. **Winter-buds** broad-ovoid, obtusely pointed, about ¼′ long, with rounded apiculate light red-brown scales. **Bark** thin, smooth, and pale.

Distribution. Rich woods; Shell Bluff on the Savannah River, Burke County, Georgia; near Birmingham, Jefferson County, and Selma, Dallas County, Alabama; near Campbell, Dunklin County, Missouri; Comal, Comal County, and Sutherland Springs, Wilson County, Texas; rare and local, and found as a tree only near Birmingham, Alabama; more abundant is the var. *mollis* Sarg. (*Aesculus austrina* Small) with bright red flowers; a tree up to 25° or 30° high, or more often a large or small shrub; valley of the lower Cape Fear River (near Wilmington, New Hanover County), North Carolina, south-

ward near the coast to the neighborhood of Charleston, South Carolina, through Georgia to the neighborhood of Rome, Floyd County, and southward to western Florida; in Alabama widely distributed from Jefferson County southward; widely distributed in Mississippi except in the neighborhood of the Gulf coast, to West Feliciana Parish, eastern Louisiana; more common and generally distributed in western Louisiana, and through eastern Texas to the valley of the San Antonio River (neighborhood of San Antonio, Bexar County) and to that of the upper Guadalupe River (near Boerne, Kendall County), ranging northward through Arkansas to southern Missouri and western Tennessee.

On the Edwards Plateau of western Texas *Aesculus discolor* is represented by the var. *flavescens* Sarg., with yellow flowers, appearing a few days earlier than those of the var. *mollis;* a shrub 9′–12′ high, or often much smaller; interesting as the only form of Eupaviæ with yellow flowers; San Marcos, Hays County, common on the slopes above Comal Springs, near New Braunfels, Comal County, near Boerne, Kendall County (with the var. *mollis*), Kerrville, Kerr County, and Cancan, Uvalde County.

6. Aesculus californica Nutt. Buckeye.

Leaves with slender grooved petioles 3′–4′ long, and 4–7 usually 5 oblong-lanceolate acuminate leaflets narrowed and acuminate or rounded at base, sharply serrate, 4′–6′ long,

Fig. 639

1½′–2′ wide, dark green above, paler below, slightly pubescent when they first appear, becoming glabrous or nearly so, on petiolules ½′–1′ long; falling early, often by midsummer. **Flowers** white or pale rose color, 1′–1¼′ long, appearing from May to July when the leaves are fully grown, on short pedicels mostly unilateral on the long branches of the densely flowered long-stemmed pubescent cluster 3′–9′ in length; calyx 2-lobed, slightly toothed, much shorter than the narrow oblong petals; stamens 5–7, with long erect exserted slender filaments and bright orange-colored anthers; ovary densely pubescent. **Fruit** obovoid, often somewhat gibbous on the outer side, with thin smooth pale brown valves, usually 1-seeded, 2′–3′ long, on a slender stalk ¼′–½′ in length; **seeds** pale orange-brown, 1½′–2′ broad.

A tree, rarely 20°–30° high, with a short trunk occasionally 4°–5° in diameter, often much enlarged at base, stout wide-spreading branches, forming a round-topped head, and branchlets glabrous and pale reddish brown when they first appear, becoming darker in their second season; more often a shrub, with spreading stems 10°–15° high forming broad dense thickets. **Winter-buds** acute, covered with narrow dark brown scales rounded on the back and thickly coated with resin. **Bark** of the trunk about ¼′ thick, smooth, and light gray or nearly white. **Wood** soft, light, very close-grained, white or faintly tinged with yellow, with thin hardly distinguishable sapwood of 10–12 layers of annual growth.

Distribution. California, borders of streams, valley of the south fork of the Salmon River, Siskiyou County, south along the coast ranges to San Luis Obispo County and on the western slope of the Sierra Nevada, usually at altitudes between 2000° and 2500°, occasionally to 5000°, to the northern slopes of Tejon Pass, Kern County, and to Antelope Valley, Los Angeles County.

Occasionally cultivated as an ornamental plant in the Pacific states, and in western and southern Europe.

XXXVII. SAPINDACEÆ.

Trees or shrubs, with alternate pinnate petiolate persistent or deciduous leaves, without stipules. Flowers regular or irregular, polygamo-diœcious, polygamo-monœcious or polygamous; calyx of 4 or 5 sepals or lobes imbricated in the bud; petals 4 or 5 imbricated in the bud; disk annular, fleshy, 5-lobed, or unilateral and oblique; stamens usually 7–10, inserted on the disk; filaments free; anthers introrse, 2-celled, the cells opening longitudinally; ovary 2–4 or 3-celled; styles terminal; stigmas capitate or lobed; ovule solitary or 2 in each cell, anatropous or amphitropous. Fruit a drupe or capsule. Seed usually solitary, without albumen; seed-coat bony, coriaceous or crustaceous.

Of the one hundred and twenty-six genera of this family, which is chiefly confined to the tropics and is more abundant in the Old than in the New World, four have arborescent representatives in the United States.

CONSPECTUS OF THE ARBORESCENT GENERA OF THE UNITED STATES.

Fruit baccate.
- Fruit dark orange-color or yellow, with thin semitranslucent coriaceous flesh; ovules 1 in each cell of the ovary; leaflets subcoriaceous to coriaceous. **1. Sapindus.**
- Fruit purple, with thick juicy flesh; ovules 2 in each cell of the ovary; leaflets thin, persistent. **2. Exothea.**

Fruit a drupe; leaves 3-foliolate, persistent. **3. Hypelate.**

Fruit a 3-valved capsule; leaves 4 or 5, rarely 3-foliolate, deciduous. **4. Ungnadia.**

1. SAPINDUS L. Soapberry.

Trees or shrubs, with terete branches, without a terminal bud, marked by large obcordate leaf-scars showing the ends of 3 equidistant fibro-vascular bundles, small globose axillary buds often superposed in pairs, the upper bud the larger, and thick fleshy roots. Leaves equally or rarely unequally pinnate. Flowers regular, minute, polygamo-diœcious, on short pedicels from the axils of minute deciduous bracts, in ample axillary or terminal panicles; sepals 4 or 5, unequal, slightly united at base; petals 4 or 5, equal, alternate with the sepals, inserted under the thick edge of the annular fleshy entire crenately lobed disk, unguiculate, naked or furnished at the summit of the claw on the inside with a 2-cleft scale, deciduous; stamens usually 8 or 10, inserted on the disk immediately under the ovary, equal; filaments subulate or filiform, often pilose, exserted in the staminate, much shorter in the pistillate flower; anthers oblong, attached near the base; pistils 2 or 3, united; ovary sessile, entire or 2–4-lobed, 2–4-celled, narrowed into a short columnar style, rudimentary in the staminate flower; stigma 2–4-lobed, the lobes spreading; ovule solitary in each cell, ascending from below the inner angle of the cell; raphe ventral; micropyle inferior. Fruit baccate, coriaceous, 1–3-seeded, usually formed of 1 globose coriaceous carpel, with the rudiments of the others remaining at its base, or of 2 or sometimes 3 carpels more or less connate by their base and then 2–3-lobed. Seed solitary in each carpel, obovoid or globose; seed-coat bony, smooth, black or dark brown; tegmen membranaceous or fleshy; hilum oblong, surrounded by an ariloid tuft of long pale silky hairs; embryo incurved or straight; cotyledons thick and fleshy, incumbent; radicle very short, inferior, near the hilum.

Sapindus is widely distributed through the tropics, especially in Asia, occasionally extending into colder regions. About forty species have been distinguished; of these three are found within the territory of the United States.

Sapindus contains a detersive principle which causes the pulp of the fruit to lather in water, and makes it valuable as a substitute for soap. The bark, which is bitter and astringent, has been used as a tonic. The seeds of several of the species are strung for chaplets and bracelets and are used as buttons.

The generic name, from *sapo* and *Indus*, refers to the detersive properties and use of the first species known to Europeans, a native of the West Indies.

CONSPECTUS OF THE SPECIES OF THE UNITED STATES.

Leaves persistent.

Rachis of the leaf interrupted-winged, with usually broad wings; leaflets 4–9, oblong-lanceolate and acute to elliptic-ovate or oblong, tomentulose below; petals without scales; fruit globose, orange-brown. 1. **S. saponaria** (D).

Rachis of the leaf without wings narrow-margined or marginless; leaflets 7–13, oblong-lanceolate, acuminate, often somewhat falcate, glabrous below; petals with scales; fruit somewhat oblong, dorsally keeled, yellow. 2. **S. marginatus** (C).

Leaves deciduous, their rachis without marginal borders; leaflets 8–18, lanceolate, mostly falcate, soft-pubescent or ultimately glabrous below; petals with scales; fruit globose, not keeled, turning black in drying. 3. **S. Drummondii** (C, E).

1. Sapindus saponaria L.

Leaves 6′–7′ long, with a broad winged rachis, the wings narrow and often nearly obsolete below the lowest pair of leaflets, and sometimes nearly ½′ wide below the upper pair, and usually 7–9 elliptic to oblong-lanceolate leaflets, rounded or slightly emargi-

Fig. 640

nate at apex, gradually narrowed at base and very short-petiolulate, soft-pubescent on the lower surface when they unfold, and at maturity rather coriaceous, yellow-green, paler and tomentulose below, prominently reticulate-venulose, 3′–4′ long and 1½′ wide, with a yellow midrib and primary veins, those of the lowest pair smaller than the others; rarely reduced to a single leaflet. **Flowers** appearing in Florida in November, usually produced 3 together on short pedicels, in terminal panicles 7′–10′ in length, with an angulate peduncle and branches; calyx-lobes acute, concave, ciliate on the margins, the 2 outer rather smaller than those of the inner rank, much shorter than the white, ovate, short-clawed petals, without scales, rounded at apex and covered, especially toward the base,

with long scattered hairs; ovary slightly 3-lobed; stamens included or slightly exserted, with hairy filaments broadened at base. **Fruit** ripening in spring or in early summer, globose, $\frac{2}{3}'$–$\frac{3}{4}'$ in diameter, with thin orange-brown semitranslucent flesh; **seeds** obovoid, black, 1′ in diameter.

A tree, sometimes 25°–30° high, with a trunk rarely exceeding 10′–12′ in diameter, erect branches and slender branchlets at first slightly many-angled and puberulous, soon glabrous, orange-green and marked by white lenticels, becoming in their second season terete, pale brown faintly tinged with red. **Bark** of the trunk $\frac{1}{4}'$–$\frac{1}{2}'$ thick, light gray and roughened by oblong lighter colored excrescences, the outer layer exfoliating in large flakes exposing the nearly black inner bark. **Wood** heavy, rather hard, close-grained, light brown tinged with yellow, with thick yellow sapwood.

Distribution. Florida, shores of Cape Sable, shores and islands of Caximbas Bay, Key Largo, Elliott's Key, and the shores of Bay Biscayne, Dade County; in Florida most common in the region of Cape Sable, and of its largest size on some of the Ten Thousand Islands, Lee County; generally distributed through the West Indies to Venezuela and Ecuador.

2. Sapindus marginatus Willd.

Sapindus manatensis Radlk.

Leaves 6′–7′ long, with a slender wingless or narrow-margined or marginless rachis, and 7–13 lance-oblong acuminate more or less falcate leaflets, glabrous, dark green, and lustrous on the upper surface, paler and glabrous or puberulous on the lower surface along the slender midrib, sessile or very short-petiolulate, 2′–5′ long, $\frac{3}{4}'$–$1\frac{1}{4}'$ wide, the lower usually alternate, the upper opposite. **Flowers** appearing in early spring, more or less tinged with red and nearly $\frac{1}{8}'$ in diameter, on short stout tomentose pedicels, in panicles 4′–5′ long and usually about 3′ wide, with a villose stem and branches; sepals acute, concave, ciliate on the margins, much shorter than the ovate-oblong, short-clawed, ciliate petals furnished on the inner surface near the base with a 2-lobed villose scale; filaments villose; ovary 3-lobed. **Fruit** conspicuously keeled on the back, short-oblong to slightly obovoid, about $\frac{3}{4}'$ long, with thin light yellow translucent flesh; **seeds** obovoid, dark brown.

Fig. 641

A tree, rarely more than 25°–30° high, with a trunk sometimes 1° in diameter, and stout pale brown or ultimately ashy gray branchlets.

Distribution. Hurricane Island at the mouth of Medway River, Liberty County,

Georgia (*Miss J. King*); hummocks, peninsula of Florida to Alachua and Manatee Counties; not common; in Cuba.

3. Sapindus Drummondii Hook. & Arn. Wild China-tree.

Leaves appearing in March and April, with a slender grooved puberulous rachis, without wings, and 4–9 pairs of alternate obliquely lanceolate acuminate leaflets, glabrous on the upper surface and covered with short pale pubescence on the lower surface, coriaceous,

Fig. 642

prominently reticulate-venulose, pale yellow-green, 2′–3′ long, ½′–⅔′ wide, short-petiolulate; deciduous in the autumn or early winter. **Flowers** appearing in May and June in clusters 6′–9′ long and 5′–6′ wide, with a pubescent many-angled stem and branches; sepals acute and concave, ciliate on the margins, much shorter than the obovate white petals rounded at apex, contracted into a long claw hairy on the inner surface and furnished at base with a deeply cleft scale hairy on the margins; filaments hairy, with long soft hairs. **Fruit** ripening in September and October, persistent on the branches until the following spring, glabrous, not keeled, yellow, ½′ in diameter, turning black in drying; **seeds** obovoid, dark brown.

A tree, 40°–50° high, with a trunk sometimes 1½°–2° in diameter, usually erect branches, and branchlets at first slightly many-angled, pale yellow-green, pubescent, becoming in their second year terete, pale gray, slightly puberulous, and marked by numerous small lenticels. **Bark** of the trunk ⅓′–½′ thick, separating by deep fissures into long narrow plates broken on the surface into small red-brown scales. **Wood** heavy, strong, close-grained, light brown tinged with yellow, with lighter colored sapwood of about 30 layers of annual growth; splitting easily into thin strips and largely used in the manufacture of baskets used in harvesting cotton, and for the frames of pack-saddles.

Distribution. Moist clay soil or dry limestone uplands; southwestern Missouri to northeastern and southern Kansas, eastern Louisiana (Tangipahoa Parish *R. S. Cocks*), and to extreme western and southwestern Oklahoma, through eastern Texas to the Rio Grande, over the Edwards Plateau, and in the mountain valleys of western Texas, southern Colorado, and of southern New Mexico and Arizona; in northern Mexico.

2. EXOTHEA Macf.

A tree, with thin scaly bark, and terete branchlets covered with lenticels. Leaves petiolate, abruptly pinnate or 3 or rarely 1-foliolate, glabrous, without stipules, persistent; leaflets oblong or oblong-ovate, acute, rounded or emarginate at apex, with entire undulate

margins, obscurely veined, thin, dark green and lustrous on the upper surface and slightly paler on the lower surface. Flowers regular, polygamo-dicœcious, on short pedicels from the axils of minute deciduous bracts covered with thick pale tomentum, in ample terminal or axillary wide-branched panicles clothed with orange-colored pubescence; sepals 5, ovate, rounded at apex, ciliate on the margins, puberulous, persistent; petals 5, white, ovate, rounded at apex, short-unguiculate, alternate with and rather longer and narrower than the sepals; disk annular, fleshy, irregularly 5-lobed, puberulous; stamens 7 or 8, inserted on the disk, as long as the petals in the staminate flower, much shorter in the pistillate flower; filaments filiform, glabrous, anthers oblong, with a broad connective, rudimentary in the staminate flower; ovary sessile on the disk, conic, pubescent, 2-celled, contracted into a short thick style, rudimentary in the staminate flower, stigma large, declinate, obtuse; ovules 2 in each cell, suspended from the summit of the inner angle, collateral, anatropous, raphe ventral; micropyle superior. Fruit a nearly spherical 1-seeded berry containing the rudiment of the second cell and tipped with the short remnant of the style, surrounded at base by the persistent reflexed sepals; flesh becoming thick, dark purple, and juicy at maturity. Seed short-oblong to subglobose, solitary, suspended; seed-coat thin, coriaceous, orange-brown and lustrous; embryo subglobose, filling the cavity of the seed; cotyledons fleshy, plano-convex, puberulous; radicle superior, very short, uncinate, turned toward the small hilum and inclosed in a lateral cavity of the seed-coat.

The genus is represented by a single West Indian species.

The generic name is from ἐξωθέω, in allusion to its removal from a related genus.

1. Exothea paniculata Radlk. Ironwood. Ink Wood.

Leaves appearing in April, on stout grooved petioles $\frac{1}{2}'$–$1'$ in length; leaflets $4'$–$5'$ long and $1\frac{1}{2}'$–$2'$ wide. **Flowers** opening in Florida in April, $\frac{1}{4}'$ across when expanded, the staminate and pistillate on separate plants. **Fruit** fully grown by the end of June and then $\frac{1}{2}'$–$\frac{3}{8}'$

Fig. 643

long, and dull orange color, remaining on the branches during the summer, ripening in the autumn; **seeds** $\frac{1}{4}'$–$\frac{3}{8}'$ in diameter.

A tree, sometimes 40°–50° high, with a trunk $12'$–$15'$ in diameter, slender upright branchlets orange-brown when they first appear, becoming reddish brown in their second year and thickly covered by small white lenticels. **Bark** of the trunk $\frac{1}{8}'$–$\frac{1}{4}'$ thick, the bright red surface separating into large scales. **Wood** very hard and heavy, strong, close-grained, bright red-brown, with lighter colored sapwood of 10–12 layers of annual growth; valued for piles and also used in Florida in boatbuilding, for the handles of tools, and many small articles.

Distribution. Florida, Mosquito Inlet on the east coast to the shores of Bay Biscayne

and on the Everglade Keys, Dade County, and on the southern keys; on the Bahamas, on many of the Antilles, and in Guatemala; on the Florida Keys generally distributed, but not common.

3. HYPELATE P. Br.

A glabrous tree or shrub, with smooth bark and slender terete branchlets. Leaves long-petioled, the petioles sometimes narrow-winged, 3-foliolate, the terminal leaflet rather larger than the others, persistent; leaflets sessile, obovate, rounded or rarely acute or emarginate at apex, entire, with thickened revolute margins and a prominent midrib, coriaceous, feather-veined, the veins arcuate and connected near the margins, dark green and lustrous on the upper surface, bright green on the lower surface. Flowers regular, polygamo-monœcious, minute, on slender pedicels from the axils of minute deciduous bracts, in few-flowered long-stemmed wide-branched terminal or axillary panicles; calyx 5-lobed, the lobes ovate, rounded at apex, slightly puberulous on the outer surface, ciliate on the margins, deciduous by a circumscissile line, petals 5, rather longer than the calyx-lobes, rounded, spreading, ciliate on the margins, white; stamens 7 or 8, inserted on the lobes of the annular fleshy disk; filaments filiform, as long as the petals in the staminate flower, much shorter in the pistillate flower; anthers oblong, attached on the back near the bottom, the cells spreading from above downward; ovary sessile on the disk, slightly 3-lobed, 3-celled, contracted into a short stout style, rudimentary in the staminate flower; stigma large, declinate, obscurely 3-lobed; ovules 2 in each cell, borne on the middle of its inner angle, superposed, amphitropous, the upper ascending, with the micropyle inferior, the lower pendulous, with the micropyle superior. Fruit an ovoid black drupe crowned with the remnants of the persistent style and supported on the persistent base of the disk; flesh thin and fleshy; walls of the stone thick and crustaceous. Seed solitary by the abortion of the upper ovule, suspended, obovoid; seed-coat thin, slightly wrinkled; embryo conduplicate, filling the cavity of the seed; cotyledons thin, foliaceous, irregularly folded, incumbent on the long radicle.

The genus with a single species is distributed from southern Florida to the Bahamas, Cuba, Porto Rico, St. Martin, Anguilla and Jamaica.

Hypelate is the ancient name of the Butcher's Broom.

1. Hypelate trifoliata Sw. White Ironwood.

Leaves unfolding in June and persistent until their second season or longer; petioles stout, $1\frac{1}{2}'$–$2'$ in length, with narrow green wings; leaflets $1\frac{1}{2}'$–$2'$ long and $\frac{3}{4}'$–$1\frac{1}{4}'$ wide.

Fig. 644

Flowers appearing in Florida in June, rather less than $\frac{1}{8}'$ in diameter, in few-flowered panicles $3'$–$4'$ long, on a slender peduncle, the staminate and pistillate in separate panicles

on the same tree. **Fruit** ripening in September, $\frac{3}{8}'$ long, with a sweet rather agreeable flavor.

A tree, sometimes 35°–40° high, with a trunk occasionally 18′–20′ in diameter, and branchlets pale green when they first appear, becoming gray during their first season and bright red-brown the following year; generally much smaller. **Bark** of the trunk rarely $\frac{1}{8}'$ thick, marked by shallow depressions and numerous minute lenticels. **Wood** very heavy, hard, close-grained, rich dark brown, with thin darker colored sapwood of 4 or 5 layers of annual growth; very durable in contact with the soil and valued in Florida for posts; also used in shipbuilding and for the handles of tools.

Distribution. Southern Florida, Upper Metacombe, Umbrella and Windley's Keys; rare.

4. UNGNADIA Endl.

A tree or shrub, with thin pale gray fissured bark, slender terete slightly zigzag branchlets, without a terminal bud, marked by large conspicuous obcordate leaf-scars, small obtuse nearly globose winter-buds covered with numerous chestnut-brown imbricated scales, and thick fleshy roots. Leaves long-petioled, 5 or 7 or rarely 3-foliolate, deciduous; leaflets ovate-lanceolate, acuminate, rounded or cuneate, and often oblique at base, irregularly crenulate-serrate, coated when they first appear on the lower surface like the petiole with dense pale tomentum, and pilose above, glabrous at maturity with the exception of a few hairs on the lower surface along the principal veins, pinnately veined, reticulate-venulose, the terminal leaflet long-petiolulate, the others short-petiolulate to subsessile. Flowers irregular, polygamous, in small pubescent fascicles or corymbs appearing just before or with the leaves from the axils of those of the previous year, usually from separate buds, or occasionally from the base of leafy branches; calyx 5-lobed, hypogynous, the lobes oblong-lanceolate, somewhat united irregularly at base only, deciduous; petals 4 by the suppression of the anterior one, or 5 and then alternate with the lobes of the calyx, hypogynous on the margin of a thickened truncate torus, unguiculate, bright rose color, deciduous, the claw as long as the lobes of the calyx, nearly erect, clothed with tomentum, especially on the inner surface, conspicuously appendaged at the summit with a fimbricated crest of short fleshy tufted hairs, the blade obovate, spreading, often erose-crenulate; disk unilateral, oblique, tongue-shaped, surrounding and connate with the base of the stipe of the ovary; stamens 7–10, usually 8 or 9, inserted on the oblique edge of the disk, much exserted and unequal, the anterior ones shorter than the others, equal or almost so and shorter than the petals in the pistillate flower; filaments filiform; anthers oblong, attached near the base; ovary ovoid, 3-celled, pilose, raised on a long stipe, rudimentary in the staminate flower; style subulate, filiform, elongated, slightly curved upward; stigma minute, terminal; ovules 2, borne on the inner angle of the cell near its middle, ascending, the micropyle inferior. Fruit a coriaceous 3-celled loculicidally 3-valved broad-ovoid capsule, conspicuously stipitate, crowned with the remnants of the style, rugosely roughened and dark reddish brown, loculicidally 3-valved, the valves somewhat cordate, bearing the dissepiment on the middle. Seed generally solitary by abortion, almost globose; seed-coat coriaceous, very smooth and shining, dark chestnut-brown or almost black; hilum broad; tegmen thin; embryo filling the cavity of the seed; cotyledons thick and fleshy, nearly hemispheric, conferruminate, incumbent on the short conic descending radicle turned toward the hilum, remaining below ground in germination.

Ungnadia with a single species is confined to Texas, New Mexico, and northern Mexico.

The name is in honor of Baron Ferdinand von Ungnad, Ambassador of the Emperor Rudolph II. at the Ottoman Porte who sent seeds of the Horsechestnut-tree from Constantinople to Vienna in the middle of the sixteenth century.

1. Ungnadia speciosa Endl. Spanish Buckeye.

Leaves appearing from March to April with or just after the flowers, 6′–12′ long, with a petiole 2′–6′ in length, rather coriaceous leaflets, dark green and lustrous on the upper sur-

face and pale and rugose on the lower surface, 3′–5′ long and 1½′–2′ wide, the terminal leaflet on a petiolule ¼′–1′ in length. **Flowers** 1′ across when expanded, in crowded clusters 1½′–2′ long. **Fruit** 2′ broad, opening in October, the empty pods often remaining on the branches until the appearance of the flowers the following year; **seeds** ½′–⅝′ in diameter.

A tree, occasionally 25°–30° high, with a trunk 6′–8′ in diameter, dividing at some distance from the ground into a number of small upright branches, and branchlets light orange-brown and covered during their first season with short fine pubescence, and pale brown tinged with red, glabrous and marked by scattered lenticels in their second year; more often a shrub, with numerous stems. **Winter-buds** about ⅛′ in diameter. **Bark** of

Fig. 645

the trunk rarely more than ¼′ thick, light gray and broken by numerous shallow reticulated fissures. **Wood** heavy, close-grained, rather soft and brittle, red tinged with brown, with lighter colored sapwood. The sweet seeds possess powerful emetic properties and are reputed to be poisonous.

Distribution. Borders of streams, river-bottoms and limestone hills, and westward on the sides of mountain cañons; valley of the Trinity River, Dallas County and of the lower Brazos River, Texas, to the mountains of southeastern New Mexico, and southward into Mexico; most common and of its largest size forty to fifty miles from the Texas coast west of the Colorado River.

Occasionally cultivated as an ornamental plant in the southern United States.

XXXVIII. RHAMNACEÆ.

Trees or shrubs, with scaly or naked buds, watery bitter astringent juice, simple leaves, and minute deciduous stipules (*persistent in Krugiodendron*). Flowers small, mostly greenish, perfect (*polygamo-dœcious in one species of Rhamnus*); calyx 4–5-lobed, the lobes valvate in the bud; petals 4–5, inserted on the calyx near the margin of the conspicuous disk lining the short calyx-tube, and infolding the stamens, or 0; stamens as many as and alternate with the calyx-lobes, free, inserted at or below the margins of the disk; filaments slender, subulate; anthers introrse, versatile, 2-celled, the cells opening longitudinally; pistils of 2–3 united carpels; ovary 2–3-, or rarely 1-celled by abortion, partly immersed in the disk; style terminal; stigma 2–4-lobed; ovules 1 in each cell, erect, anatropous; raphe ventral; micropyle inferior. Fruit drupaceous, supported on the tube of the calyx and bearing the remnants of the style. Seed usually with scanty oily albumen; embryo with broad cotyledons; radicle inferior, next the hilum.

CONSPECTUS OF THE ARBORESCENT GENERA OF THE UNITED STATES.

Fruit more or less fleshy.
- Fruit with a single stone; petals 0.
  - Sepals without crests.
    - Leaves alternate; branches spinescent. — 1. Condalia.
    - Leaves nearly opposite; branches not spinescent. — 2. Reynosia.
  - Sepals crested; leaves mostly opposite. — 3. Krugiodendron.
- Fruit with 2 or 3 nutlets; petals 4 or 5, or 0; leaves alternate. — 4. Rhamnus.

Fruit crustaceous, 3-lobed, separating into 3 longitudinally 2-valved nutlets.
- Sepals inflexed; petals narrowed into a long slender claw. — 5. Ceanothus.
- Sepals spreading; petals sessile. — 6. Colubrina.

1. CONDALIA Cav.

Trees or shrubs, with rigid spinescent branches and minute scaly buds. Leaves alternate, subsessile, obovate or oblong, entire, feather-veined. Flowers axillary, solitary or fascicled, greenish white, on short pedicels; calyx with a short broad-obconic tube and a 5-lobed limb, the lobes ovate, acute, membranaceous, spreading and persistent; disk fleshy, flat, slightly 5-angled, surrounding the free base of the ovary; petals 0; stamens 5, inserted on the free margin of the disk between the lobes of the calyx; filaments incurved, shorter than the calyx-lobes; ovary 1-celled, conic, gradually narrowed into a short thick style; stigma 3-lobed; ovule ascending from the base of the cell. Fruit ovoid or subglobose; flesh thin; stone thick-walled, crustaceous. Seed compressed; seed-coat thin and smooth; cotyledons oval, flat.

Condalia with nine or ten species is confined to the New World and is distributed from western Texas and southern California to Brazil and Argentina. Of the six species found within the territory of the United States one is a small tree.

The generic name commemorates that of Antonio Condal, a Spanish physician of the eighteenth century sent to South America on a scientific mission in 1754.

1. Condalia obovata Hook. Purple Haw. Log Wood.

Leaves often fascicled on short spinescent lateral branchlets, spatulate to oblong-cuneate, mucronate, when they first appear pubescent, especially on the lower surface, at

Fig. 646

maturity glabrous, rather thin, pale yellow-green, 1′–1½′ long, and about ⅓′ wide, with a conspicuous midrib and usually 3 pairs of prominent primary veins; unfolding in May and

June and falling irregularly during the winter. **Flowers** in 2–4-flowered short-stemmed fascicles, on branchlets of the year. **Fruit** ripening irregularly during the summer, $\frac{1}{4}'$ long, dark blue or black, with a sweet pleasant flavor.

A tree, sometimes 30° high, with a trunk 6′–8′ in diameter, erect rigid zigzag branchlets terminating in a stout spine and covered at first with soft velvety pubescence, becoming glabrous before the end of their first season, pale red-brown and often covered with thin scales; more often a shrub. **Bark** of the trunk about $\frac{1}{5}'$ thick, divided into flat shallow ridges, the dark brown surface tinged with red separating into thin scales. **Wood** very heavy, hard, close-grained, light red, with light yellow sapwood of 7–8 layers of annual growth; burning with an intense heat and valued as fuel.

Distribution. Southwestern Texas from Jackson County (Vanderbilt) and Corpus Christi, Nueces County, to the Rio Grande and to Comal and Valverde Counties; in northeastern Mexico; of tree-like habit and of its largest size on the high sandy banks of the lower Rio Grande and its tributaries; often covering large areas with dense impenetrable chaparral.

2. REYNOSIA Griseb.

Trees or shrubs, with rigid unarmed terete branches, and scaly buds. Leaves mostly opposite, entire, coriaceous, short-petiolate, reticulate-veined, persistent. Flowers minute, on stout pedicels bibracteolate near the base and two or three times longer than the flower, in small axillary sessile umbels; calyx persistent, 5-lobed, the lobes deltoid or ovate, acute or acuminate, spreading, petaloid, deciduous; disk fleshy; petals 0; stamens 5, inserted on the margin of the disk, rather shorter than the calyx-lobes; filaments incurved; anthers oval; ovary free from the disk, almost superior, conic, 2–3-celled, contracted into a short erect thick style; stigma 2–3-lobed. Fruit drupaceous; flesh thin; stone crustaceo-membranaceous. Seed ovoid or subglobose; seed-coat very thin, conspicuously rugose and tuberculate; embryo axile in copious subcorneous ruminate albumen; cotyledons oblong.

Reynosia is distributed from southern Florida and the Bahama Islands to the Antilles. Four species are recognized; of these, one, a small tree, extends into southern Florida.

The generic name is in honor of Alvaro Reynoso (1830–1888), the distinguished Cuban chemist and writer on agriculture and scientific subjects.

1. Reynosia septentrionalis Urb. Red Ironwood. Darling Plum.

Leaves oblong to ovate or obovate, or sometimes nearly orbicular, rounded, truncate or

Fig. 647

frequently emarginate and usually minutely apiculate at apex, gradually narrowed at base into a short broad petiole, very thick and coriaceous, dark green on the upper, rather paler

or often rufous on the lower surface, 1′–1½′ long and ½′ broad, with thickened revolute margins, a stout broad midrib, about five pairs of primary veins spreading nearly at right angles, and numerous reticulate veinlets; unfolding in April and remaining on the branches for one and sometimes for two years. **Flowers** yellowish green appearing in May, $\frac{1}{12}$′ long; sepals ovate, acute. **Fruit** ripening in Florida in November or frequently not until the following spring, short-obovoid, ½′ long, purple or nearly black, edible, with an agreeable flavor.

A tree, 20°–25° high, with a trunk 6′–8′ in diameter, stout terete rigid branchlets slightly puberulous when they first appear, soon becoming glabrous and gray faintly tinged with red, growing darker in their second season, then often covered by small tubercles and marked by the prominent elevated leaf-scars. **Winter-buds** minute, chestnut-brown. **Bark** of the trunk $\frac{1}{16}$′–⅛′ thick, dark-red-brown, and divided into large plate-like scales. **Wood** heavy, exceedingly hard, strong, close-grained, rich dark brown, with light brown sapwood of 15–20 layers of annual growth.

Distribution. Florida, coast and islands from the Marquesas group to the shores of Bay Biscayne and the Everglade Keys, Dade County; common and generally distributed; on the Bahama Islands.

3. KRUGIODENDRON Urb.

A small tree or shrub, with slender unarmed terete branches roughened by numerous small lenticels, and minute scaly buds. Leaves opposite or obliquely opposite, or sometimes alternate on lower branches, ovate or oval, often emarginate, coriaceous, entire, short-petiolate, feather-veined, persistent; stipules acuminate, persistent. Flowers greenish yellow, on short slender pedicels, in axillary simple or dichotomously branched cymes; calyx broad-obconic, 5-lobed, the lobes triangular, acute, erect or spreading, conspicuously crested on the inner surface, deciduous; disk annular, broad, fleshy, 5-lobed, surrounding the base of the ovary; petals 0; stamens 5, inserted under the margin of the disk; anthers ovoid or ovoid-orbicular, obtuse; ovary conic, imperfectly 2-celled; styles short and thick, united nearly to the apex, the branches spreading and stigmatic on the inner face; ovule ascending from the base of the cell. Fruit 1-seeded, oval or ovoid; flesh thin and black; wall of the stone thin and bony. Seed ellipsoid, compressed, without albumen; seed-coat membranaceous; embryo filling the cavity of the seed; cotyledons thick and fleshy, obovate or elliptic.

Krugiodendron, with a single species, is confined to southern Florida and the West Indies.

The generic name is in honor of Leopold Krug (1833–1898), a student of the flora of the Antilles.

1. Krugiodendron ferreum Urb. Black Ironwood.

Leaves bright green and lustrous above, pale yellow-green below, glabrous with the exception of a few scattered hairs on the upper surface and on the petiole, 1′–1½′ long and ¾′–1′ wide, with entire or slightly undulate margins; persistent for two or three years; petioles stout, ¼′ in length. **Flowers** on bibracteolate pedicels ¼′ long, in 3–5-flowered cymes on peduncles sometimes ½′ in length, usually much shorter and often branched near the apex, on branchlets of the year; calyx about $\frac{1}{16}$′ long. **Fruit** generally solitary, ⅓′ in length, on a stem ⅓′–½′ long.

A tree, sometimes 30° high, with a trunk 8′–10′ in diameter, and slender branchlets at first green and covered with dense velvety pubescence, becoming glabrous in their second year, and then gray faintly tinged with red and roughened by small crowded lenticels; generally much smaller and more often shrubby than arborescent. **Bark** of the trunk about ¼′ thick and divided into prominent rounded longitudinal ridges broken on the surface into short thick light gray scales. **Wood** exceedingly heavy, hard, strong, close-grained, brittle, rich orange-brown, with thin lighter colored sapwood.

Distribution. Florida, Cape Canaveral on the east coast to the shores of Bay Biscayne

and on the Everglade Keys, Dade County, near Cape Sable, and on the southern keys; one of the commonest of the small trees of the region; on the Bahama Islands and on several of the Antilles.

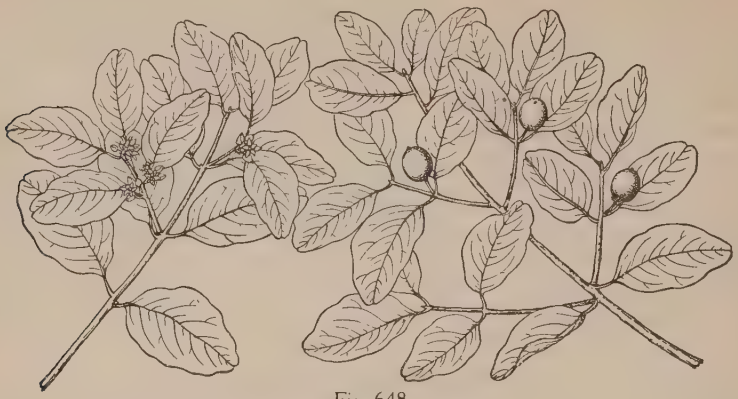

Fig. 648

4. RHAMNUS L.

Trees or shrubs, with terete often spinescent branches, without a terminal bud, scaly or naked axillary buds and acrid bitter bark. Leaves alternate or rarely obliquely opposite, conduplicate in the bud, petiolate, feather-veined, entire or dentate, stipulate. Flowers perfect or polygamo-dicœcious, in axillary simple or compound racemes or fascicled cymes; calyx campanulate, 4–5-lobed, the lobes triangular-ovate, erect or spreading, keeled on the inner surface, deciduous; disk thin below, more or less thickened above; petals 5, inserted on the margin of the disk, ovate, unguiculate, emarginate, infolded round the stamens, deciduous, or 0; stamens 4 or 5; filaments very short; anthers oblong-ovoid or sagittate, rudimentary and sterile in the pistillate flower; ovary free, ovoid, included in the tube of the calyx, 2–4-celled, rudimentary in the staminate flower; styles united below, with spreading stigmatic lobes or terminating in a 2–3-lobed obtuse stigma; ovule erect from the base of the cell. Fruit drupaceous, oblong or spherical; flesh thick and succulent, inclosing 2–4 separable cartilaginous 1-seeded nutlets. Seeds erect, obovoid, grooved longitudinally on the back, with a cartilaginous seed-coat, the raphe in the groove, or convex on the back, with a membranaceous seed-coat, the raphe lateral next to one margin of the cotyledons; embryo large, surrounded by thin fleshy albumen; cotyledons oval, foliaceous, with revolute margins, or flat and fleshy.

Rhamnus with about sixty species is widely distributed in nearly all the temperate and in many of the tropical parts of the world with the exception of Australasia and the islands of the Pacific Ocean. Of the five species indigenous to the United States three attain the size of small trees. The fruit and bark of Rhamnus are drastic, and yield yellow and green dyes. The European *Rhamnus cathartica* L., the Buckthorn, has long been used as a hedge plant in northern Europe, and in eastern North America, where it has now become sparingly naturalized.

The generic name is from *ῥάμνος*, the classical name of the Buckthorn.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT SPECIES.

Flowers polygamo-dicœcious, in sessile umbels; calyx 4-lobed; petals 0; anthers oblong-ovoid; lobes of the stigma elongated, spreading; fruit red; seed grooved on the back; seed-coat cartilaginous; leaves often sharply toothed, persistent; winter-buds scaly.
1. R. crocea (G).

Flowers perfect, in pedunculate umbels; calyx 5-lobed; petals 5; anthers sagittate; lobes of the stigma short and obtuse; fruit black; seed rounded on the back; seed-coat membranaceous; leaves deciduous; winter-buds naked.

Peduncles shorter than the petioles. 2. **R. caroliniana** (C).

Peduncles longer than the petioles. 3. **R. Purshiana** (B, G).

1. Rhamnus crocea Nutt.

Leaves persistent, often in fascicles, elliptic, broad-ovate to suborbicular, rounded and often apiculate at apex, glandular-denticulate with minute teeth, coriaceous, yellow-green and lustrous on the upper surface, pale and frequently bronzed or copper color on the lower surface, glabrous or often puberulous while young, with a prominent midrib and slender primary veins, $\frac{1}{4}'$–$\frac{3}{4}'$ long; petioles short and stout; stipules minute, acuminate. **Flowers** polygamo-dicœcious, on slender often puberulous pedicels, in small clusters from the axils of the leaves or of small lanceolate persistent bracts on shoots of the year; calyx 4-lobed, with acuminate lobes, about $\frac{1}{8}'$ long; petals 0; stamens rather shorter than the calyx, with short stout incurved filaments and large ovoid anthers, minute and rudimentary in the pistillate flower; ovary ovoid, contracted into a long slender style divided above the middle into two wide-spreading acuminate stigmatic lobes, rudimentary in the staminate flower. **Fruit** red, obovoid, slightly grooved or lobed at maturity, $\frac{1}{4}'$ long, with thin dry flesh and 1–3 nutlets; **seed** broad-ovoid, pointed at apex, deeply grooved on the back and $\frac{1}{8}'$ long, with a thin membranaceous pale chestnut-colored coat.

A shrub, 6′–3° high, with slender rigid often spinescent branchlets forming thickets.

Distribution. Coast mountains of central and southern California. Passing into

Rhamnus crocea var. ilicifolia Greene.

Leaves oval or orbicular, spinulose-dentate, often golden beneath and $1'$–$1\frac{1}{2}'$ long and $\frac{3}{4}'$–$1'$ wide. **Flowers** with 4 or occasionally 5 calyx-lobes and stamens.

A tree, occasionally 25° high, with a trunk 6′–8′ in diameter, stout spreading branches, and slender branchlets yellow-green and puberulous or glabrate when they first appear, becoming dark red or reddish brown and glabrous in their second season. **Winter-buds** obtuse, barely more than $\frac{1}{16}'$ long, with small puberulous apiculate imbricated scales ciliate on the margins. **Bark** of the trunk usually from $\frac{1}{16}'$–$\frac{1}{8}'$ thick, the dark gray surface slightly roughened by minute tubercles.

Fig. 649

Distribution. California, valley of the Sacramento River southward along the western slopes of the Sierra Nevada, and on the coast ranges and southern mountains to San Diego

County; Arizona, Oak Creek and Sycamore Cañons, near Flagstaff, Coconino County, (*P. Lowell*), Copper Cañon, west of Camp Verde, Yavapai County, and on the Pinal and Santa Catalina Mountains.

Passing into

Rhamnus crocea var. insularis Sarg.

A form with larger less prominently toothed leaves sometimes 3′ long and 1½′ wide, rather larger flowers, with shorter and broader calyx-lobes a less deeply divided style,

Fig. 650

and larger fruits. A tree often growing to the height of 25°–30°, flowering later than the var. *ilicifolia*, and not uncommon on the islands of the Santa Barbara group and on the mountains of the adjacent mainland. A form (f. *pilosa* Trel.) with narrow revolute leaves densely pilose throughout, occurs in the Santa Maria valley of the mountains near San Diego.

2. Rhamnus caroliniana Walt. Indian Cherry.

Leaves deciduous, elliptic-oblong or broad-elliptic, acute or acuminate, cuneate or somewhat rounded at base, remotely and obscurely serrate, or crenulate, densely coated when they unfold with rusty brown tomentum, and at maturity thin, dark yellow-green above, paler below, glabrous or somewhat hairy on the lower surface, 2′–6′ long and 1′ to nearly 2′ wide, with a prominent yellow midrib and about 6 pairs of conspicuous yellow primary veins; turning yellow in the autumn before falling; petioles slender, pubescent, ½′ to nearly 1′ in length; stipules nearly triangular. **Flowers** appearing from April to June when the leaves are almost fully grown, on slender pedicels about ¼′ long, in few-flowered pubescent umbels, on peduncles varying from ⅛′–½′ in length; calyx 5-lobed, with a narrow turbinate tube and triangular lobes; petals 5, broad-ovate, deeply notched at apex and folded round the short stamens; ovary contracted into a long columnar style terminating in a slightly 3-lobed stigma. **Fruit** ripening in September and sometimes remaining on the branches until the beginning of winter, globose, ⅓′ in diameter, black, with thin sweet rather dry flesh and 2–4 nutlets; **seeds** obtuse at apex, rounded on the back, reddish brown, about ⅕′ long.

A tree, 30°–40° high, with a trunk 6′–8′ in diameter, small spreading unarmed branches, and slender branchlets light red-brown and puberulent or covered with a glaucous bloom when they first appear, becoming slightly angled, gray, and glabrous, and marked during their second season by the small horizontal oval leaf-scars; more often a tall shrub, with numerous stems 15°–20° high. **Winter-buds** naked, hoary-tomentose. **Bark** of the trunk about ⅛′ thick, slightly furrowed, ashy gray and often marked by large black blotches. **Wood** rather hard, light, close-grained, not strong, light brown, with lighter colored sapwood of 5 or 6 layers of annual growth.

Distribution. Borders of streams on rich bottom-lands, and on limestone ridges; Virginia to western Florida and westward through the valley of the Ohio River to eastern

Fig. 651

Kansas, the valley of the Washita River, Oklahoma (Carter County), and to Kendall, Kerr and Uvalde Counties, western Texas; occasionally tree-like in western Florida and Mississippi, and of its largest size only in southern Arkansas and the adjacent portions of Texas; very abundant on the limestone barrens of central Kentucky and Tennessee.

3. Rhamnus Purshiana DC. Bearberry. Coffee-tree.

Leaves deciduous, broad-elliptic, obtuse or bluntly pointed at apex, rounded or slightly cordate at base, finely serrate, or often nearly entire, with undulate margins, thin, villose with short hairs on the lower surface and on the veins above, $1\frac{1}{2}'$–$7'$ long, $1\frac{1}{2}'$–$2'$ wide, conspicuously netted-veined, with a broad and prominent midrib and primary veins; turning pale yellow late in the autumn before falling; petioles stout, often pubescent, $\frac{1}{2}'$–$1'$ in length; stipules membranaceous, acuminate. **Flowers** on slender pubescent pedicels $\frac{1}{4}'$–$1'$ long, in axillary cymes on slender pubescent peduncles $\frac{1}{2}'$–$1'$ in length on shoots of the year; calyx nearly campanulate, with 5 spreading acuminate lobes; petals 5, minute, ovate, deeply notched at apex, and folded round the short stamens; stigma 2 or 3-lobed. **Fruit** globose or broad-obovoid, black, $\frac{1}{3}'$–$\frac{1}{2}'$ in diameter, slightly or not at all lobed, with thin rather juicy flesh, and 2 or 3 obovoid nutlets usually $\frac{1}{3}'$ long, rounded on the back, flattened on the inner surface, with 2 bony tooth-like enlargements at base, 1 on each side of the large scar of the hilum, and a thin gray or pale yellow-green shell; **seeds** obtuse at apex, rounded on the back; seed-coat thin and papery, yellow-brown on the outer surface, bright orange color on the inner surface like the cotyledons.

A tree, 35°–40° high, with a slender trunk often $18'$–$20'$ in diameter, separating 10°–15° from the ground into numerous stout upright or sometimes nearly horizontal branches, and slender branchlets coated at first with fine soft pubescence, pale yellow-green or reddish brown, and pubescent, glabrous, or covered with scattered hairs in their second season and then marked by the elevated oval horizontal leaf-scars; often shrubby and occasionally prostrate. **Winter-buds** naked, hoary-tomentose. **Bark** of the trunk rarely more than $\frac{1}{4}'$ thick, dark brown to light brown or gray tinged with red, broken on the surface into short thin scales. **Wood** light, soft, not strong, brown tinged with red, with thin lighter colored sapwood. The bark possesses the drastic properties peculiar to that of other species of the genus, and is a popular domestic remedy in Oregon and California, and under the name of Cascara Sagrada has been admitted into the American materia medica.

Distribution. Rich bottom-lands and the sides of cañons, usually in coniferous forests; shores of Puget Sound eastward along the mountain ranges of northern Washington to the Bitter Root Mountains of Idaho and the shores of Flat Head Lake, Montana, and southward to central California; Arizona, southern slope of the Grand Cañon of the Colorado

Fig. 652

River, Coconino County (*A. Rehder*), Cave Creek Cañon, Chiricahua Mountains, Cochise County (*J. W. Toumey*).

Occasionally cultivated in the gardens of western Europe and of the eastern United States.

5. CEANOTHUS L.

Small trees or shrubs, with slender terete branches, without a terminal bud, and small scaly axillary buds. Leaves petiolate, 3-ribbed from the base, or pinnately veined, persistent in the arborescent species. Flowers on colored pedicels, in umbellate fascicles collected in dense or prolonged terminal or axillary thyrsoid cymes or panicles, blue or white; calyx colored, with a turbinate or hemispheric tube and 5 triangular membranaceous petaloid lobes; disk fleshy, thickened above; petals 5, inserted under the margin of the disk, unguiculate, wide-spreading, deciduous, the long claw infolded round the stamens; stamens 5, inserted with and opposite the petals, persistent, filaments spreading; ovary partly immersed in and more or less adnate to the disk, 3-celled, sometimes 3-angled, the angles often surmounted by a fleshy gland persistent on the fruit; styles short, united below; stigmas 3-lobed with spreading lobes; ovule erect from the base of the cell. Fruit 3-lobed, subglobose, with a thin outer coat, soon becoming dry, and separating into 3 crustaceous or cartilaginous longitudinally 2-valved nutlets. Seeds erect, obovoid, lenticellate, with a broad basal excrescence surrounding the hilum; seed-coat thin, crustaceous; albumen fleshy; embryo axile; cotyledons oval or obovate.

Ceanothus is confined to the temperate and warmer regions of North America, with about thirty species, mostly belonging to California. The leaves, bark, and roots are astringent and tonic. Of the species of the United States three are small trees.

The generic name is from κεάνωθος, the classical name of some spiny plant.

CONSPECTUS OF THE ARBORESCENT SPECIES OF THE UNITED STATES.

Branchlets not spinose, leaves 3-ribbed.

Leaves broad-ovate to elliptic, subcordate or rounded at base, pale and tomentose below.

1. C. arboreus (G).

Leaves elliptic, acute at base, glabrous except on the veins below.
2. C. thyrsiflorus (G).

Branchlets spinose; leaves with a single midrib, mostly elliptic, rounded or subcordate at base, glabrous.
3. C. spinosus (G).

1. Ceanothus arboreus Greene.

Leaves broad-ovate or elliptic, acute, conspicuously glandular-crenate, dark green and softly puberulent on the upper surface, pale and densely tomentose on the lower surface, $2\frac{1}{2}'$–$4'$ long and $1'$–$2\frac{1}{2}'$ wide, with prominent veins; petioles stout, pubescent, $\frac{1}{2}'$–$1'$ in length; stipules subulate from a broad triangular base, $\frac{1}{4}'$ long. **Flowers** pale blue opening in July and August, on slender hairy pedicels $\frac{1}{2}'$–$1'$ long, from the axils of large scarious caducous bracts, in ample compound densely hoary-pubescent thyrsoid clusters $3'$–$4'$ long and $1\frac{1}{2}'$–$2'$ wide, on a leafy or naked axillary peduncle at the end of young branches. **Fruit** black, $\frac{1}{4}'$ across.

A round-headed tree, 20°–25° high, with a straight trunk $6'$–$10'$ in diameter, dividing 4°–5° from the ground into many stout spreading branches, and slender slightly angled pale brown branchlets covered with short dense tomentum, becoming in their second season

Fig. 653

terete, nearly glabrous, roughened with scattered lenticels and marked by large elevated leaf-scars; often a shrub. **Bark** of the trunk dark brown, about $\frac{1}{8}'$ thick, and broken into small square plates separating into thick scales.

Distribution. Santa Catalina, Santa Cruz, and Santa Rosa Islands of the Santa Barbara group off the coast of southern California; most abundant and of its largest size on the northern slopes of Santa Cruz; on the other islands usually shrubby, with numerous slender stems.

2. Ceanothus thyrsiflorus Eschs. Blue Myrtle. California Lilac.

Leaves oblong or oblong-ovate, minutely glandular-serrate, smooth and lustrous on the upper surface and paler and slightly pubescent on the lower surface, especially along the 3 prominent ribs, $1'$–$1\frac{1}{2}'$ long and $\frac{1}{2}'$–$1'$ wide; petioles stout, $\frac{1}{3}'$–$\frac{1}{2}'$ in length; stipules membranaceous, acute. **Flowers** blue or white, appearing in early spring in small pedunculate corymbs from the axils of minute deciduous bracts, and collected into slender rather loose thyrsoid clusters $2'$–$3'$ long in the axils of upper leaves or of small scarious bracts, and usually surmounted by the terminal leafy shoot of the branch. **Fruit** ripening from July to December, black; **seeds** $\frac{1}{12}'$ long, smooth, dark brown or nearly black.

A tree, occasionally 35° high, with a trunk $12'$–$14'$ in diameter, dividing 5°–6° from the

ground into many small wide-spreading branches, and conspicuously angled pale yellow-green branchlets slightly pubescent when they first appear, soon becoming glabrous; more often a tall or low shrub. **Bark** of the trunk thin, with a bright red-brown surface separating into thin narrow appressed scales. **Wood** close-grained, rather soft, light brown, with thin darker colored sapwood.

Distribution. Shady hillsides on the borders of the forest and often in the neighborhood of streams; coast mountains of California from Mendocino County to the valley of the San

Fig. 654

Luis Rey River, San Diego County; of its largest size northward, and in the Redwood-forests of the Santa Cruz Mountains; southward often a low shrub, frequently flowering on the wind-swept shores of the ocean when only 1°–2° high.

3. Ceanothus spinosus Nutt. Lilac.

Leaves elliptic to oblong, full and rounded, apiculate or often slightly emarginate or gradually narrowed and pointed or rarely 3-lobed at apex, and rounded or cuneate at base, when

Fig. 655

they unfold villose-pubescent below along the stout midrib and obscure primary veins, soon glabrous, coriaceous, usually about 1′ long and ½′ wide; petioles stout, ⅛′–⅓′ in length, at first villose, becoming nearly glabrous; leaves on vigorous shoots sometimes ovate, con-

spicuously 3-nerved, irregularly serrate with incurved apiculate teeth, or coarsely dentate, and often 1½′ long and ⅝′ wide; stipules minute, acute. **Flowers** light or dark blue, very fragrant, opening from March until May, in lax corymbs from the axils of acute pubescent red caducous bracts on upper leafy branchlets of the year, the whole inflorescence forming an open thyrsus often 5′–6′ long and 3′–4′ thick, leafless toward the apex. **Fruit** depressed, obscurely lobed, crestless, black, ¼′–⅓′ in diameter.

A tree, 18°–20° high, with a trunk 5′–6′ in diameter, upright branches forming a narrow open head, and slender divaricate angled branchlets pubescent or puberulous when they first appear, soon glabrous, bright green, ultimately reddish brown, frequently terminating in sharp leafless thorn-like points; more often shrubby. **Bark** of the trunk thin, red-brown, roughened by small closely appressed scales.

Distribution. California, common in mountain cañons near the coast of Santa Barbara, Ventura, and Los Angeles Counties; often forming a dense undergrowth in the forest, which it enlivens for many weeks in early spring by its large clusters of bright blue flowers.

6. COLUBRINA Brong.

Trees or shrubs, with terete branches and scaly buds. Leaves alternate, petiolate, pinnately veined or triple-veined from the base, often ferrugineo-tomentose on the lower surface, persistent. Flowers axillary, in contracted few-flowered cymes or fascicles, yellow or greenish yellow; calyx-tube hemispheric, persistent, 5-lobed, the lobes spreading, triangular-ovate, keeled on the inner surface, deciduous by a circumscissile line; disk fleshy, annular, 5-angled or indistinctly 5 or 10-lobed; petals 5 yellow or white, inserted under the margin of the disk, shorter than the lobes of the calyx, cucullate, unguiculate, infolding the stamens; stamens 5, opposite to and inserted with the petals; filaments incurved; anthers ovoid; ovary surrounded by and confluent with the disk, 3-celled, subglobose, contracted into a slender 3-lobed style, the obtuse lobes stigmatic on the inner face; ovule erect, from the base of the cell. Fruit subglobose, 3-lobed, the outer coat thin and septicidally dehiscent into 3 1-seeded crustaceous nutlets 2-valved at apex. Seeds erect, broad-obovoid, compressed, 3-angled; seed-coat coriaceous, smooth and shining; embryo axile in thick fleshy albumen; cotyledons orbicular, flat or incurved, thin or fleshy.

Colubrina with about a dozen species is confined to the tropics, with the largest number of species in the New World. Of the four species found within the territory of the United States three are arborescent.

The generic name is from *coluber*, a serpent, probably on account of the peculiar twisting of the deep furrows on the stems of some of the species.

CONSPECTUS OF THE ARBORESCENT SPECIES OF THE UNITED STATES.

Leaves thin, elliptic, ovate or lanceolate, glabrous at maturity. 1. **C. reclinata** (D).
Leaves thick or coriaceous.
Leaves oblong to elliptic, rounded or acute at apex, densely soft-pubescent. 2. **C. cubensis** (D).
Leaves elliptic to ovate-lanceolate, bluntly pointed at apex, coriaceous, rusty-pubescent beneath. 3. **C. arborescens** (D).

1. Colubrina reclinata Brong. Naked Wood.

Leaves elliptic, ovate or lanceolate, usually contracted at apex into a blunt point, cuneate or somewhat rounded and furnished with 2 conspicuous marginal glands at base, and entire when they unfold in early summer thin, glabrous or finely puberulent below and along the principal veins, and at maturity thin, yellow-green, 2½′–3′ long and 1½′ to nearly 2′ wide, with a stout midrib and arcuate primary veins; persistent until their second year; petioles slender, ½′ in length. **Flowers** in cymes rather shorter than the petioles, on shoots of the year, pubescent, soon becoming glabrate. **Fruit** ¼′ in diameter and dark orange-red, ripening late in the autumn, on pedicels ½′ in length; **seeds** light red-brown, ⅛′ long.

A tree, 50°–60° high, with a trunk 3°–4° in diameter, divided by numerous irregular deep furrows multiplying and spreading in all directions, and branchlets slightly angled when they first appear, puberulent and reddish brown, soon becoming glabrate, and in their

Fig. 656

second season nearly terete, gray or light brown, and marked by numerous small light-colored lenticels. **Bark** of the trunk thin, orange-brown, exfoliating in large papery scales. **Wood** heavy, hard, very strong, dark brown tinged with yellow, with thin light yellow sapwood of 8–10 layers of annual growth.

Distribution. Florida, on Umbrella Key, the north end of Key Largo, and on some of the small keys south of Elliott's Key; of its largest size and forming a forest of considerable extent on Umbrella Key; on the Bahama Islands and on many of the Antilles.

2. Colubrina cubensis Brong.

Leaves oblong to elliptic, gradually narrowed and rounded or acute and apiculate at apex, rounded or cuneate at the often unsymmetric base, slightly crenulate-serrate with

Fig. 657

broad rounded teeth, thick, dull dark green and soft-pubescent on the upper surface, pale and pubescent on the lower surface, $3\frac{1}{2}'$–$5'$ long and $1\frac{1}{4}'$–$1\frac{1}{2}'$ wide, with a prominent pubescent yellow midrib and slender primary veins; petioles slender, yellow, densely pubescent, $\frac{1}{3}'$–$\frac{1}{2}'$ in length; stipules linear-lanceolate, long-acuminate, pubescent, $\frac{1}{3}'$ in length. **Flowers** minute on pedicels $\frac{1}{6}'$ long, from the axils of ovate acuminate villose caducous bracts, in villose cymes on peduncles longer than the petioles; calyx densely pubescent, the lobes triangular, ovate, acute, about as long as the yellow petals. **Fruit** globose, about $\frac{1}{3}'$ in diameter.

A tree in Florida from 20°–30° high, with a trunk 6′–8′ in diameter (*teste J. K. Small*) and slender light red-brown pubescent branchlets.

Distribution. Florida, hummocks of the Everglade Keys, Dade County; on the Bahama Islands and in Cuba and Hispaniola.

3. Colubrina arborescens Sarg.

Colubrina Colubrina Mills.

Leaves coriaceous, persistent, elliptic to ovate-lanceolate, gradually narrowed and bluntly pointed at apex, narrowed and rounded or cuneate at base, entire, dark green, glabrous and lustrous on the upper surface, pale and coated on the lower surface with thick rusty pubescence and sometimes marked by conspicuous glands mostly at the end of small veins, $2'$–$4\frac{1}{2}'$ long and $1\frac{1}{4}'$–$2\frac{1}{2}'$ wide, with a thick midrib; petioles stout, rusty-pubescent, $\frac{1}{2}'$–$\frac{3}{4}'$ in length; stipules oblong, acuminate, rusty-pubescent, caducous. **Flowers** minute, in axillary cymes shorter than the petioles, covered with persistent rusty pubescence and generally produced on short axillary branches; petals white or nearly white. **Fruit** on a stout rusty-pubescent pedicel, about $\frac{1}{2}'$ long, on a much thickened peduncle, obovoid to

Fig. 658

subglobose, dark purple or nearly black, $\frac{5}{12}'$ in diameter; nutlets light yellow; seed about $\frac{1}{6}'$ long.

A tree, sometimes 25° high, with a straight trunk 8′–12′ in diameter, large erect branches and stout branchlets densely rusty-pubescent when they first appear, and light gray, puberulous and marked by small dark lenticels in their second year; in Florida more often a shrub.

Distribution. Florida, on the Everglade and southern keys; on the Bahama Islands and on several of the Antilles.

XXXIX. TILIACEÆ.

Trees, shrubs, or herbs, with alternate simple leaves, and free stipules. Flowers regular, perfect; sepals valvate in the bud, deciduous; corolla hypogynous; stamens numerous, with 2-celled anthers, the cells opening longitudinally; pistil compound; styles united into 1; stigma capitate. Fruit capsular or nut-like. Seeds with albumen; embryo with broad foliaceous cotyledons.

The Linden family with forty-four genera is chiefly tropical, with more representatives in the southern than in the northern hemisphere. Of the three North American genera only Tilia is arborescent.

1. TILIA L. Bass Wood. Linden.

Trees, with terete moderately stout branchlets, without a terminal bud, large compressed acute axillary buds, with numerous imbricated scales, those of the inner rank accrescent, mucilaginous juice, and tough fibrous inner bark. Leaves conduplicate in the bud, long-petiolate, 2-ranked, cordate or truncate at the oblique base, acute or acuminate, serrate, deciduous, their petioles in falling leaving large elevated horizontal leaf-scars displaying the ends of numerous fibro-vascular bundles; stipules ligulate, membranaceous, caducous. Flowers nectariferous, fragrant, on slender clavate pedicels, in axillary or terminal cymes, with minute caducous bracts at the base of the branches, their peduncle more or less connate with the axis of a large membranaceous light green ligulate often obovate persistent conspicuously reticulate-veined bract: sepals 5, distinct; petals 5, imbricated in the bud, alternate with the sepals, sometimes thickened and glandular at the narrow base, creamy white or yellow, deciduous; stamens inserted on a short hypogynous receptacle; filaments filiform, forked near the apex, collected into 5 clusters and united at base with each other and (in the American species) with a spatulate petaloid scale (*staminodium*) placed opposite each petal, the branches of the filament bearing oblong extrorse half anthers; ovary sessile, tomentose, 5-celled, the cells opposite the sepals; style erect, dilated at apex into 5 spreading stigmatic lobes; ovules 2 in each cell, ascending from the middle of its inner angle, semianatropous, the micropyle centripetal-inferior. Fruit nut-like, woody, subglobose to short-oblong or ovoid, sometimes ribbed, tomentose, 1-celled by the obliteration of the partitions, 1 or 2-seeded. Seeds obovoid, amphitropous, ascending; seed-coat cartilaginous, light reddish brown; embryo large, often curved, in fleshy albumen; cotyledons reniform or cordate, palmately 5-lobed, the margins irregularly involute or crumpled; radicle inferior.

Tilia with some thirty species is widely distributed in the temperate regions of the northern hemisphere with the exception of western America, central Asia, and the Himalayas. Tilia produces soft straight-grained pale-colored light wood, largely used for the interior finish of buildings, in cabinet-making, for the sounding-boards of pianos, wood-carving and wooden ware, and in the manufacture of paper. The tough inner bark is largely manufactured into mats, cords, fish-nets, coarse cloths, and shoes. Lime-flower oil, obtained by distilling the flowers of the European species, is used in perfumery. The flowers yield large quantities of nectar, and honey made near forests of Tilia is unsurpassed in flavor and delicacy. Many of the species are planted as shade and ornamental trees, and some of the European species are now common in the gardens and parks of the eastern United States.

CONSPECTUS OF THE SPECIES OF THE UNITED STATES.

Surface of the leaves glabrous at maturity.

Leaves glabrous or almost glabrous when they unfold, coarsely serrate.

Leaves furnished with conspicuous tufts of axillary hairs, their lower surface light green and lustrous; pedicels glabrous or nearly glabrous. 1. **T. glabra** (A).

Leaves usually without tufts of axillary hairs, their lower surface not lustrous; pedicels densely hoary-tomentose. 2. **T. nuda** (C).

Leaves hoary-tomentose when they unfold.
Leaves soon glabrous.
Leaves coarsely serrate with stout teeth, their veinlets conspicuous; branchlets stout, bright red. 3. **T. venulosa** (A).
Leaves finely serrate with straight or incurved teeth, their veinlets less conspicuous; branchlets slender, pale reddish brown. 4. **T. littoralis** (C).
Leaves crenately serrate, glaucescent on the lower surface. 5. **T. crenoserrata** (C).
Leaves covered below early in the season with articulate hairs, becoming glabrous or nearly glabrous.
Leaves thin, coarsely serrate, green or glaucescent on the lower surface, with or without tufts of axillary hairs; summer shoots not pubescent. 6. **T. floridana** (C).
Leaves subcoriaceous, finely serrate, bluish green and lustrous below early in the season; tufts of axillary hairs minute, usually wanting; summer shoots pubescent. 7. **T. Cocksii** (C).
Surface of the leaves pubescent below during the season.
Lower surface of the leaves covered with short gray firmly attached pubescence; tufts of axillary hairs not conspicuous. 8. **T. neglecta** (A,C).
Lower surface of the leaves covered with articulate easily detached hairs.
Branchlets without straight hairs.
Leaves ovate, acuminate, usually obliquely truncate at base, glabrous above, their pubescence brownish or white. 9. **T. caroliniana** (C).
Leaves oblong-ovate, cordate or obliquely cordate at base, pubescent above early in the season. 10. **T. texana** (C).
Leaves semiorbicular to broad-ovate, abruptly short-pointed, deeply and usually symmetrically cordate at base. 11. **T. phanera** (C).
Branchlets covered with straight hairs; leaves ovate, abruptly short-pointed, oblique and truncate at base. 12. **T. lasioclada** (C).
Surface of the leaves tomentose below during the season with close firmly attached tomentum.
Tomentum white, gray, or brown; leaves usually glabrous on the upper surface; branchlets and winter-buds glabrous (*occasionally pubescent in varieties of 13*).
Branchlets slender; petioles not more than $1\frac{1}{2}'$ in length; leaves oblong-ovate, acuminate or abruptly pointed, oblique and truncate or cordate at base; tomentum on the leaves of upper branches often brown; flowers $\frac{1}{4}'$–$\frac{1}{3}'$ long. 13. **T. heterophylla** (A, C).
Branchlets stout; petioles up to $3'$ in length; leaves oblong-ovate, acuminate, obliquely truncate at base; tomentum always white; flowers $\frac{5}{12}'$–$\frac{1}{2}'$ long. 14. **T. monticola** (A).
Tomentum pale or brownish; leaves thickly covered above early in the season with fascicled hairs; branchlets tomentose; winter-buds pubescent. 15. **T. georgiana** (C).

1. Tilia glabra Vent. Linden. Bass Wood.

Tilia americana L.

Leaves broad-ovate, contracted at apex into a slender acuminate entire point, obliquely cordate or sometimes almost truncate at base, coarsely serrate with incurved glandular teeth, often slightly pubescent when they first appear soon glabrous with the exception of tufts of rusty brown hairs in the axils of the principal veins below, thick and firm, dark dull green on the upper surface, lighter, yellow-green and lustrous on the lower surface, $5'$–$6'$ long and $3'$–$4'$ wide; turning pale yellow in the autumn before falling; petioles slender, $1\frac{1}{2}'$–$2'$ in length. **Flowers** $\frac{1}{2}'$ long, opening early in July on slender slightly angled pubescent pedicels, in few-flowered slender-branched glabrous cymes; peduncle slender, glabrous, the free portion $3\frac{1}{2}'$–$4'$ long, its bract rounded or pointed at apex, $4'$–$5'$ long, $1'$–$1\frac{1}{2}'$ wide, decurrent nearly to the base or to within $\frac{1}{2}'$–$1'$ of the base of the peduncle; sepals ovate, acuminate, densely hairy on the inner surface and slightly pubescent on the outer

surface, a third shorter than the lanceolate petals; staminodia oblong-obovate, bluntly pointed at apex, a third shorter than the petals; ovary villose; style covered with rufous tomentum. **Fruit** short-oblong to oblong-obovoid, rounded or pointed at apex, $\frac{1}{3}'$–$\frac{1}{2}'$ long, and covered with short thick rufous tomentum.

A tree, usually 60°–70°, or sometimes 120°–130° high, with a tall trunk 3°–4° in diameter, small often pendulous branches forming a broad round-topped head, slender smooth gla-

Fig. 659

brous light gray or light brown branchlets marked by numerous oblong dark lenticels, becoming darker in their second and dark gray or brown and conspicuously rugose in their third year. **Winter-buds** dark red, ovoid, about $\frac{1}{4}'$ long. **Bark** of the trunk about 1′ thick, deeply furrowed, the light brown surface broken into small thin scales. **Wood** light brown faintly tinged with red, with thick hardly distinguishable sapwood of 55–65 layers of annual growth; employed in the manufacture of paper pulp, and under the name of white wood largely used in wooden ware, cheap furniture, the panels of carriages, and for the inner soles of shoes.

Distribution. Rich often moist soil, formerly often in nearly pure forests; northern New Brunswick to the eastern shores of Lake Superior, the southern shores of Lake Winnipeg and the valley of the Assiniboine River, and southward to Pennsylvania, Ohio, eastern Kentucky, southern Michigan, Indiana and Illinois, eastern Nebraska and northern Missouri.

Often cultivated as a shade and ornamental tree in the northeastern states, and occasionally in Europe.

2. Tilia nuda Sarg.

Leaves thin, ovate, abruptly pointed at apex, obliquely truncate or unsymmetrically cordate at base, and coarsely serrate with long slender straight or slightly curved conspicuously glandular teeth, as they unfold, dark red and sparingly pubescent on the midrib and veins, glabrous at the end of a few days, without or rarely with small axillary tufts, dark green on the upper surface, pale yellow-green or glaucous (var. *glaucescens* Sarg.) on the lower surface, 4′–$4\frac{1}{2}'$ long and $2\frac{1}{2}'$–$3\frac{1}{2}'$ wide; petioles slender, glabrous, 2′–$2\frac{1}{2}'$ in length. **Flowers** opening early in June, about $\frac{1}{3}'$ long, on hoary-tomentose pedicels, in broad usually 10 or 12, sometimes 30 or 40-flowered long-branched glabrous cymes; peduncle glabrous, the free portion $\frac{4}{5}'$–$1\frac{1}{4}'$ in length, its bract oblong, often slightly falcate, cuneate or rounded at base, rounded at apex, glabrous, 3′–4′ long, $\frac{1}{2}'$–$1\frac{1}{4}'$ wide, decurrent nearly to the base of the peduncle; sepals acute, rusty-tomentose on the outer surface, glabrous on the inner surface; petals oblong-ovate, narrowed at the rounded apex; staminodia

oblong-obovate rounded at the broad apex; style glabrous. **Fruit** ripening in September, subglobose to depressed-globose, covered with rusty tomentum, $\frac{1}{4}'$–$\frac{1}{3}'$ in diameter.

Usually a small tree with pale furrowed or sometimes checkered bark, small spreading branches forming a narrow round-topped head, and slender glabrous orange or red-brown branchlets. **Winter-buds** ovoid, obtusely pointed, dull red, glabrous, $\frac{1}{6}'$–$\frac{1}{5}'$ long.

Distribution. Central and southwestern Mississippi (Hinds and Adams Counties); Dallas County, Alabama; West Feliciana and Calcasieu Parishes, Louisiana, to the valley of the Brazos River, eastern Texas, and to Hempstead County (Fulton and McNab), southern Arkansas; the var. *glaucescens* with the type, and near Page, Le Flore County, Oklahoma; in wet woods subject to overflow at San Augustine, San Augustine County, Texas, a va-

Fig. 660

riety (var. *brevipedunculata* Sarg.), differs from the type in the less coarsely serrate smaller leaves glaucescent below, in the shorter free portion of the peduncle of the inflorescence and its broader bract. A tree 25°–30° high, with slender glabrous dark red-brown branchlets.

3. Tilia venulosa Sarg.

Leaves broad-ovate, abruptly acuminate at apex, cordate or unsymmetrically cordate or obliquely truncate or cordate at base, coarsely serrate with gland-tipped teeth pointing forward, covered when they unfold with pale tomentum, soon becoming pubescent, and glabrous before the flowers open, dark yellow-green on the upper surface, paler on the lower surface, 4′–4¾′ long and broad, with a prominent pale yellow midrib slightly villose on the upper side near the base, and 9 or 10 pairs of remote primary veins without axillary tufts and connected by conspicuous cross veinlets; petioles stout, glabrous, 1¾′–2′ in length. **Flowers** opening early in July, $\frac{1}{3}'$ long, on slightly pubescent pedicels, in broad slender-branched nearly glabrous cymes; peduncle stout, glabrous, red, the free portion 1′–1½′ in length, its bract oblong to slightly obovate, gradually narrowed and rounded at base, rounded at apex, glabrous on the upper surface, pubescent below on the midrib and veins, 3½′–6′ long and 1¼′–1½′ wide, longer than the peduncle and decurrent nearly to its base or to within 1′–1½′ of its base; sepals ovate, acute, pale pubescent on the outer surface, villose and furnished at base on the inner surface with a tuft of long white hairs, a third shorter than the lanceolate acuminate petals; staminodia oblong-obovate, rounded at apex, about as long as the sepals; stigma slightly villose at base. **Fruit** ripening the end of September, subglobose, $\frac{1}{4}'$–$\frac{1}{3}'$ in diameter, covered with loose light brown pubescence.

A tree, 60°–75° high, with stout red glabrous branchlets. **Winter-buds** ovoid, cylindric, obtusely pointed, dark red, $\frac{1}{4}'$–$\frac{1}{3}'$ in length.

Distribution. North Carolina, rocky "coves" in rich soil, Hickory Nut Gap, in the

Blue Ridge, and near Saluda, Polk County, passing into var. *multinervis* Sarg., differing from the type in its obliquely truncate, not cordate, leaves with 12 or 13 pairs of more

Fig. 661

crowded primary veins, ellipsoid fruit, slender branchlets, and smaller winter-buds; a single tree near Saluda, Polk County.

4. Tilia littoralis Sarg.

Leaves ovate, abruptly short-pointed and acute or acuminate at apex, unsymmetric and rounded on one side and cuneate on the other, or symmetric and cuneate or oblique and truncate at base, and finely serrate with straight or incurved glandular teeth, covered above when they unfold with scattered fascicled hairs and tomentose below, soon glabrous,

Fig. 662

and when the flowers open, thin, yellow-green, paler, rarely glaucous (var. *discolor* Sarg.) on the lower than on the upper surface, 3′–4′ long and 1¾′–2′ wide, with a slender midrib

and primary veins and small conspicuous tufts of rusty brown axillary hairs; petioles slender, glabrous, 1′–1½′ in length; leaves on young vigorous shoots broad-ovate, truncate or slightly cordate at base, more coarsely serrate, pubescent with fascicled hairs especially on the midrib and veins, 4′–5′ long and 3′–4′ wide; petioles densely pubescent. **Flowers** opening the middle of June, ⅓′ long, on pale tomentose pedicels, in small, compact, mostly 9–15-flowered, pubescent cymes; peduncle covered with scattered fascicled hairs, the free portion ⅗′–1′ long, its bract gradually narrowed and cuneate at base, rounded at apex, ciliate on the margins, pubescent on the midrib, otherwise glabrous, 2′–7′ long, ¼′–⅖′ wide, longer or shorter than and decurrent to the base or nearly to the base of the peduncle; sepals acuminate, pale pubescent on the outer surface, villose on the inner surface along the margins and at the base with long white hairs; petals acuminate; staminodia oblong-obovate, rounded at apex. **Fruit** ellipsoid to depressed-globose, apiculate, covered with pale brown tomentum, ¼′–⅓′ in diameter.

A tree with slender glabrous branchlets densely coated when they first appear with pale pubescence, soon glabrous, light reddish brown during their first summer, often bright red during their first winter, becoming purple the following year and ultimately light gray-brown. **Winter-buds** ovoid, glabrous or puberulous, bright red, about ⅕′ long and 1/12′–⅛′ in diameter.

Distribution. Georgia, shore of Colonel's Island near the mouths of the North Newport and Medway Rivers, near Durham, Liberty County; the var. *discolor* with the type.

5. Tilia crenoserrata Sarg.

Tilia floridana Sarg., not Small.

Leaves ovate, abruptly narrowed and acuminate at apex, usually oblique and unsymmetrically cordate or truncate or occasionally symmetrical and cordate at base, crenately serrate, the teeth tipped with minute glands, covered when they unfold with pale caducous tomentum, and at maturity dark green and lustrous above, glaucescent below, glabrous with the exception of minute axillary tufts of rusty hairs, mostly 3½′–5½′ long and 2¾′–3′ wide; petioles slender, glabrous, about 1¼′ in length. **Flowers** opening the middle of June, ⅓′ long, on hoary-tomentose pedicels, in compact mostly 10–18-flowered tomentose cymes; peduncle glabrous, the free portion 1′–1½′ in length, its bract oblong-obovate, cuneate at base, rounded at apex, glabrous, 3′–5′ long, usually about ⅘′ wide, decurrent nearly to the base of the peduncle; sepals acute, hoary-tomentose on the outer surface, coated with pale tomentum mixed with long white hairs on the inner surface; petals narrow-acuminate; staminodia oblong-obovate, notched at apex. **Fruit** ripening from the middle to the end of August, ellipsoid, conspicuously apiculate at apex, rusty-tomentose, ⅓′–⅖′ long and ¼′–⅓ in diameter.

A tree, 25°–30°, rarely 60° high, with a trunk 10′–12′ rarely 18′–20′ in diameter, and slender glabrous red-brown branchlets. **Winter-buds** ovoid, acute, dark dull red, glabrous, 1/6′–⅕′ long.

Distribution. Near Albany, Dougherty County, Georgia, to central Florida (Levy, Columbia, Alachua, Putnam, Seminole and Orange Counties).

6. Tilia floridana Small.

Leaves broad-ovate, acuminate or abruptly acuminate at apex, cordate or obliquely truncate at base and coarsely serrate with apiculate teeth, tinged with red and tomentose below when they unfold, fully grown and glabrous or nearly glabrous when the flowers open late in May or in early June, and at maturity thin, glabrous, dark yellow-green on the upper surface, pale or rarely covered below with a silvery white bloom (var. *hypoleuca* Sarg.), 3½′–5′ long and 2½′–3½′ wide, with a slender midrib and primary veins; in the east usually without axillary tufts, often present and sometimes conspicuous westward; petioles slender, glabrous, ¾′–1′ in length. **Flowers** opening in early summer ⅕′–¼′ long, on hoary-tomentose rarely puberulous (var. *australis* Sarg.) pedicels, in few-flowered rather compact

pubescent corymbs; peduncle pubescent, the free portion $1\frac{1}{2}'$–$2\frac{1}{2}'$ in length, its bract oblong-obovate to oblong, rounded at apex, often falcate, glabrous, 3′–6′ long, $\frac{1}{2}'$–$\frac{3}{4}'$ wide, decurrent nearly to the base of the peduncle; sepals narrow, ovate, acuminate, hoary-tomentose on the outer surface, sparingly villose on the inner surface, two-thirds as long as the lanceolate petals; staminodia oblong-obovate, acute, nearly as long as the petals; style glabrous. **Fruit** ripening in August and September, subglobose to ellipsoid, rusty-tomentose, $\frac{1}{2}'$ in diameter.

A tree, 40°–50° high, with a trunk 12′–15′ in diameter, and slender glabrous red-brown or yellow branchlets. **Winter-buds** obtuse, dark red-brown, glabrous, about $\frac{1}{6}'$ long.

Distribution. North Carolina (Polk County) to western Florida and westward through northern and central Alabama, central Mississippi, northern and western Louisiana, eastern and over the Edwards Plateau to Kerr, Bandera and Uvalde Counties, Texas, and through

Fig. 663

southern and western Arkansas to eastern Oklahoma, Missouri and eastern Kentucky; in northeastern Mexico; the var. *australis* in Blount County, Alabama. A variety (var. *oblongifolia* Sarg.) with narrower more elongated leaves with more prominent tufts of axillary hairs occurs in Putnam, Leon and Gadsden Counties, Florida, on the bluffs of the Alabama River near Berlin, Dallas County, Alabama, in Hinds, Rankin and Adams Counties, Mississippi, in West Feliciana, Iberia (Avery Island) and Natchitoches Parishes, Louisiana, in Hempstead and Salina Counties, Arkansas, and in Harris, Anderson and Livingston Counties, Texas.

7. Tilia Cocksii Sarg.

Leaves ovate, abruptly acuminate at apex, very oblique at the truncate or rounded base, dentate with small remote glandular apiculate teeth, covered when they unfold with loose floccose pubescence, nearly glabrous when fully grown early in April, when the flowers open the middle of May dark green and lustrous on the upper surface, pale blue-green and lustrous below, and at mid-summer when the fruit ripens, subcoriaceous, dark green and lustrous on the upper surface, paler on the lower surface, with slender primary veins without or occasionally with minute axillary tufts, and connected by conspicuous straight or curved veinlets, $3\frac{1}{2}'$–$4'$ long and $2\frac{1}{2}'$–$3'$ wide; petioles slender, glabrous, $\frac{3}{4}'$–$1'$ in length;

leaves on leading summer branchlets sometimes obliquely cordate, more coarsely serrate, covered on the upper surface with short fascicled hairs, and floccose-pubescent on the lower surface, 4′–5′ long and 4′–4¾′ wide, their petioles puberulous. **Flowers** opening the middle of May, ¼′ long, on tomentose pedicels, in compact pubescent many-flowered cymes; peduncle slender, glabrous, the free portion only ⅜′–½′ in length, its bract oblong, occasionally

Fig. 664

slightly obovate, rounded at the ends, hoary-tomentose on the under surface and pubescent on the upper surface when it first appears, and when the flowers open puberulous below and glabrous above, 3½′–6′ long, ½′–⅗′ wide and shorter than and decurrent to the base of the peduncle; sepals ovate, acuminate, pale pubescent on the outer surface, villose at the base on the inner surface, a third shorter than the lanceolate acuminate petals; staminodia oblong-obovate, rounded at apex, about half the length of the petals; style glabrous. **Fruit** ripening the middle of July, globose to depressed-globose, covered with loose brown tomentum, ¼′ in diameter.

A small tree with slender dull red glabrous branchlets, the leading branchlets in summer more or less pubescent. **Winter-buds** ovoid, acute, dull red, glabrous or pubescent on leading shoots, ⅛′–¼′ long.

Distribution. Louisiana, river banks and low woods, Lake Charles and West Lake Charles, Calcasieu Parish.

8. Tilia neglecta Spach.

Tilia Michauxii Sarg., not Nutt.

Leaves thick and firm, acute or abruptly narrowed and long-pointed at apex, obliquely concave or unsymmetrically cordate at base, coarsely serrate with straight apiculate teeth pointing forward, dark green, smooth, glabrous and lustrous above, covered below except on the midrib and veins more or less thickly with short gray pubescence often slightly tinged with brown, and furnished with conspicuous tufts of axillary hairs, usually 4′–5½′ long and 2½′–4½′ wide; petioles stout, glabrous, 1¼′–2½′ in length. **Flowers** opening in June and July about ⅔′ long, on pubescent or nearly glabrous pedicels, in long-branched slender glabrous mostly 5–15-flowered cymes; peduncle slender, glabrous, the free portion 1¼′–1½′ in length, its bract gradually narrowed and cuneate or unsymmetrically cuneate or rounded at base, rounded at apex, glabrous, 2¾′–4½′ long, ⅖′–⅘′ wide and longer than and decurrent nearly to the base or to within ⅜′ of the base of the peduncle; sepals broad-ovate, acute, ciliate on the margins, glabrous on the outer surface, covered on the inner surface with long white hairs, about half as long as the lanceolate petals rounded and notched at apex and rather longer than the spatulate staminodia; stamens included; style

villose toward the base. **Fruit** ripening in September, ellipsoid, ovoid, obovoid, or depressed-globose, rounded or acute or rarely gradually narrowed and acuminate at apex, rarely 5-angled, covered with rusty or pale pubescence, usually about $\frac{1}{3}'$ in diameter.

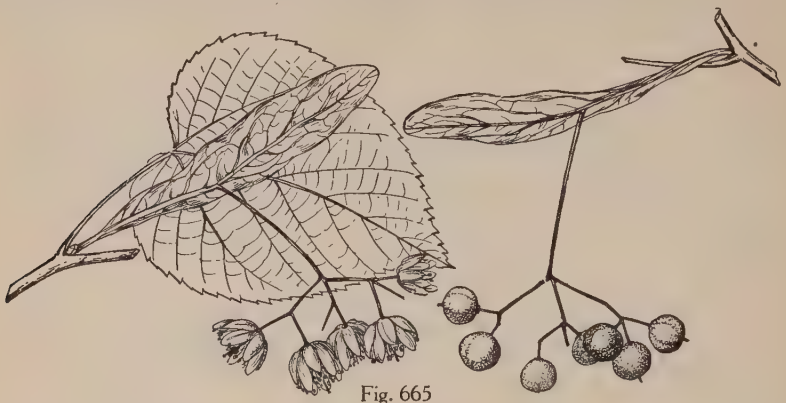

Fig. 665

A tree, 75°–90° high, with a trunk sometimes 3° in diameter, smooth often pendulous branches forming a broad round head, and slender glabrous branchlets. **Winter-buds** ovoid, rounded at the narrowed apex, about $\frac{1}{5}'$ long, with glabrous red-brown or light brown scales. **Bark** of the trunk about 1′ thick, deeply furrowed, pale reddish brown and covered with small thin scales.

Distribution. Rich moist soil, Province of Quebec, near Montreal, to the coast of Massachusetts and New York, through the middle states to the valley of the Potomac River and along the Appalachian Mountains to those of North Carolina, and to Iuka, Tishomingo County, Mississippi, and from central and western New York to northern Missouri.

9. Tilia caroliniana Mill.

Leaves ovate, oblique and truncate or cordate at base, abruptly long-pointed at apex, coarsely dentate with broad apiculate glandular teeth pointing forward, and coated below

Fig. 666

with a rusty or pale easily detached pubescence of fascicled hairs, coated when they unfold with hoary tomentum, soon glabrous on the upper surface, and at maturity dark yellow-green and lustrous above, 2¾′–4½′ long and 2½–5′ wide; petioles stout, glabrous, 1′–1½′ in length. **Flowers** opening the middle of June, ¼′ long, on slender pubescent pedicels, in small stout-branched pubescent mostly 8–15-flowered cymes; peduncle slender, pubescent, the free portion ¾′–1¼′ long, its bract oblong-obovate, cuneate at base, rounded or acute at apex, nearly glabrous on the upper surface when it first appears, pubescent becoming glabrous or almost glabrous below, 4′–5′ long and ⅓′ wide, longer or shorter than and decurrent to the base or nearly to the base of the peduncle; sepals ovate, acuminate, ciliate on the margins, brown and covered with pale pubescence on the outer surface, coated on the inner surface with long white hairs; petals lanceolate, acuminate, a third longer than the sepals; staminodia oblong-obovate, rounded at apex, rather shorter than the petals; style tomentose at base or glabrous. **Fruit** subglobose, ellipsoid or obovoid, ⅛′ in diameter.

A large tree with slender red-brown glabrous or slightly pubescent branchlets. **Winter-buds** ovoid, acute, glabrous or rarely pubescent, about ¼′ long.

Distribution. Coast of North Carolina (Wrightsville Beach and the neighborhood of Wilmington, New Hanover County), southward in the immediate neighborhood of the coast to Liberty County, Georgia; western Louisiana to southern Arkansas (Hempstead and Clark Counties) common, and through eastern Texas to the Edwards Plateau (near Boerne, Kendall County); in Orizaba. Passing into

Tilia caroliniana var. rhoophila Sarg.

Differing from the type in its pubescent branchlets and winter-buds, its usually larger leaves, and in its tomentose corymbs of more numerous flowers. **Leaves** broad-ovate, abruptly short-pointed and acuminate at apex, oblique and truncate or cordate at base,

Fig. 667

coarsely serrate with broad apiculate teeth pointing forward, dark green and lustrous on the upper surface, pale and thickly covered on the lower surface with persistent white or brownish pubescence, 4′–5′ long and 2½′–5′ wide, with a slender midrib and primary veins pubescent on the lower side, and small conspicuous axillary tufts of pale hairs; petioles stout, thickly coated with pubescence, 1′–1¾′ in length; leaves on vigorous shoots often 6′ long, and 5½′ wide, and occasionally 10′ long and 9′ wide. **Flowers** ¼′ long, on short

hoary-tomentose pedicels, in wide thin-branched pubescent many-flowered (sometimes 50) cymes; peduncle thickly covered with fascicled hairs, the free portion $\frac{1}{4}'$ long, its bract oblong, unequally rounded at base, rounded at apex, glabrous on the upper surface, pubescent on the lower surface, 4′–6′ long, 1′–2′ wide, usually shorter than and decurrent nearly to the base of the peduncle; sepals acuminate, coated on the outer surface with pale or slightly rusty pubescence, villose and furnished at base on the inner surface with tufts of long hairs; petals lanceolate, acuminate and ciliate at apex, about a third longer than the sepals; staminodia spatulate, acute, about half the length of the petals; style coated at base with long white hairs. **Fruit** subglobose, covered with rusty tomentum, about $\frac{1}{3}'$ in diameter.

A tree with slender branchlets thickly coated during their first year with pale pubescence, dark red-brown or gray and puberulous during their second season. **Winter-buds** covered with pale pubescence.

Distribution. Western Louisiana. (Calcasieu and Jefferson Davis Parishes) to Hempstead County, Arkansas, and through eastern Texas to the valley of the upper Guadalupe River, Kerr County.

10. Tilia texana Sarg.

Leaves thin, oblong-ovate, abruptly contracted into a long slender acuminate point, cordate or obliquely cordate at base, finely dentate with broad apiculate teeth, early in the

Fig. 668

season pubescent above with scattered fascicled hairs and covered below with brownish slightly attached pubescence, and in the autumn light yellow-green, lustrous and nearly glabrous on the upper surface, slightly pubescent on the lower surface, 4′–$5\frac{1}{2}'$ long and $3\frac{1}{4}'$–5′ wide, with a slender midrib and primary veins sparingly villose on the upper side and nearly glabrous on the lower side, and small axillary tufts of brownish hairs; petioles slender, pubescent with fascicled hairs, 1′–$1\frac{1}{2}'$ in length; leaves on vigorous shoots often furnished with one or two large lateral acuminate serrate lobes, more coarsely dentate and more thickly covered on the lower surface with pubescence, often $5\frac{1}{2}'$–6′ long and $3\frac{1}{2}'$–6′ wide. **Flowers** opening the middle of June, $\frac{1}{4}'$ long, on slender tomentose pedicels, in small villose-pubescent mostly 7–10-flowered cymes; peduncle slender, slightly villose-pubescent, the free portion $1\frac{1}{4}'$–$1\frac{1}{2}'$ in length, its bract oblong-ovate to slightly obovate, unsymmetrically cuneate at base, rounded and occasionally lobed at apex, glabrous on the upper sur-

face, densely pubescent early in the season, later becoming nearly glabrous on the lower surface, 3′–6′ long and $\frac{3}{4}$′–$1\frac{1}{4}$′ wide, longer or shorter than the peduncle and decurrent to its base or to within $1\frac{1}{2}$′ of its base; sepals ovate, acute, pale pubescent on the outer surface, covered on the inner surface with white hairs longer and more abundant near the base; petals lanceolate, acuminate, a third longer than the sepals; staminodia linear-lanceolate, acuminate; style hoary-tomentose at base. **Fruit** ellipsoid, covered with rusty brown tomentum, $\frac{1}{3}$′ long and $\frac{1}{4}$′ broad.

A small tree with slender branchlets thickly covered during their first season with close pale pubescence, and pale and puberulous or glabrous in their second year; on vigorous terminal branchlets often with thicker, light rusty brown pubescence. **Winter-buds** ovoid, obtusely pointed, thickly covered with pale pubescence, $\frac{1}{4}$′ long.

Distribution. Texas, Brazos and Cherokee Counties, on Spring Creek near Boerne, Kendall County, and on the rocky banks of the Guadalupe River at Kerrville, Kerr County.

11. Tilia phanera Sarg.

Leaves semiorbicular to broad-ovate, deeply and usually symmetrically cordate at base, abruptly short-pointed at apex, finely dentate with straight or incurved apiculate teeth, glabrous above when they unfold with the exception of a few hairs on the midrib and veins, and thickly coated below with hoary tomentum, and at maturity thin, blue-green, smooth and lustrous on the upper surface, paler and often brownish and coated with a floccose easily detached pubescence of fascicled hairs or scabrate (var. *scabrida* Sarg.) on the lower surface, 2′–4′ wide and usually rather broader than long, with a slender midrib and primary veins pubescent on the lower side, and small axillary clusters of rusty brown hairs; petioles slender, coated when they first appear with hoary tomentum, glabrous or slightly pubescent in the autumn, 1′–$1\frac{1}{2}$′ in length. **Flowers** opening the middle of June, $\frac{1}{5}$′ long, on tomentose pedicels, in compact villose mostly 16–20-flowered cymes; peduncle villose, the free portion $1\frac{1}{4}$′ in length, its bract obovate, cuneate at base, broad and rounded at apex, floccose-pubescent on the lower surface, nearly glabrous on the upper surface, 3′–$3\frac{1}{2}$′ long and

Fig. 669

$\frac{1}{2}$′–1′ wide, longer than the peduncle and decurrent to its base or to within $\frac{1}{4}$′ of its base; sepals acuminate, pale pubescent on the outer surface, villose on the margins and furnished at base on the inner surface with a tuft of long white hairs, broader and shorter than the lanceolate acuminate petals; staminodia oblong-obovate, rounded at apex, style glabrous except at the base. **Fruit** ripening the end of September, ellipsoid, covered with rusty tomentum, $\frac{1}{3}$′–$\frac{2}{5}$′ long and $\frac{1}{4}$′ wide, on a stout, densely floccose-pubescent pedicel.

A tree with slender light gray-brown often zigzag branchlets covered when they first appear with fascicled hairs and deciduous during their first summer. **Winter-buds** ovoid, obtusely pointed, terete, reddish brown, glabrous, $\frac{1}{8}'$–$\frac{1}{5}'$ long.

Distribution. Texas, banks of Spring Creek, near Boerne, Kendall County; the var. *scabrida* on a low limestone bluff of the Blanco River, near Blanco, Blanco County, near College Station, Brazos County, and at Velasco, Brazoria County.

12. Tilia lasioclada Sarg.

Leaves ovate, abruptly contracted at apex into a short acuminate point, oblique and truncate or on weak branchlets, often nearly symmetric and deeply cordate at base, and finely serrate with straight apiculate teeth, covered above when they unfold with soft caduous hairs and pubescent below, and at maturity thick, bright green, smooth and lustrous on the upper surface, pale and covered on the lower surface with a thick floccose easily detached pubescence of fascicled hairs, pale on those of lower leaves and often rufous on those of upper branches, 4′–6′ long and $3\frac{1}{4}'$–5′ wide, with a slender midrib and veins covered below with straight hairs mixed with fascicled hairs, and small conspicuous axillary tufts; petioles covered when they first appear with straight hairs mixed with fascicled hairs, soon glabrous, usually $1\frac{1}{4}'$–$1\frac{1}{2}'$ in length, those of the leaves of weak branchlets very slender and often 2′–$2\frac{1}{2}'$ long. **Flowers** in May, $\frac{1}{6}'$–$\frac{1}{5}'$ long, on stout villose pedicels, in long-branched mostly 10–15-flowered cymes more or less thickly covered with straight white hairs; peduncle covered with long white hairs, the free portion 1′–$1\frac{1}{4}'$ in length, its bract rounded and unsymmetric or acute at base, rounded or acute at apex, the midrib more or less thickly covered on the lower side with straight hairs, otherwise glabrous, $3\frac{1}{2}'$–5′ long and 1′ wide, decurrent nearly to the base or to within 1′ of the base of the peduncle; sepals narrow, acute. pubescent on the outer surface, villose on the inner surface, about one-third as long as the lanceolate acuminate petals; staminodia spatulate, rounded and often lobed at apex, about as long as the sepals; style slightly villose at base. **Fruit** ripening in September, globose or depressed-globose, covered with rusty tomentum, about $\frac{2}{5}'$ in diameter.

Fig. 670

A tree, sometimes 60° high, with a trunk 12′–24′ in diameter, heavy branches forming a broad round-topped head, and stout red-brown branchlets sometimes glabrous in early summer and sometimes covered more or less thickly during their first and second seasons with long straight hairs.

Distribution. Valley of the Savannah River, near Abbeville, South Carolina, to Shell Bluff, Burke County, Georgia; River Junction, Gadsden County, Florida.

13. Tilia heterophylla Vent.

Leaves ovate, obliquely truncate or rarely slightly cordate at base, gradually narrowed and acuminate at apex, finely dentate with apiculate gland-tipped teeth, pubescent above when they unfold with caducous fascicled hairs, and at maturity dark green and glabrous

Fig. 671

on the upper surface, covered on the lower surface with thick, firmly attached, white or on upper branches often brownish tomentum, and usually furnished with small axillary tufts of rusty brown hairs, $3\frac{1}{4}'$–$5\frac{1}{4}'$ long and $2\frac{1}{2}'$–$2\frac{3}{4}'$ wide; petioles slender, glabrous, $1\frac{1}{2}'$–$1\frac{3}{4}'$ in length. **Flowers** $\frac{1}{4}'$ long, opening in early summer, on pedicels pubescent with fascicled hairs, in wide mostly 10–20-flowered pubescent corymbs; peduncle glabrous, the free portion $\frac{1}{12}'$–$\frac{1}{6}'$ in length, its bract narrowed and rounded at apex, unsymmetrically cuneate at base, pubescent on the upper surface, tomentose on the lower surface when it first appears, becoming glabrous, 4′–6′ long and $1'$–$1\frac{1}{2}'$ wide, nearly sessile or decurrent to within $1\frac{1}{2}'$ of the base of the peduncle; sepals acuminate, pale-pubescent on the outer surface, villose on the inner surface and furnished at base with a tuft of long white hairs; petals lanceolate, acuminate, a third longer than the sepals; staminodia oblong-ovate, acute, sometimes notched at apex; style villose at base with long white hairs. **Fruit** ellipsoid, apiculate at apex, covered with rusty brown tomentum, about $\frac{1}{3}'$ long.

A large tree with slender, glabrous, reddish or yellowish brown branchlets and oblong-ovate slightly flattened glabrous winter-buds $\frac{1}{5}'$–$\frac{1}{3}'$ in length, the outer scales slightly ciliate at apex.

Distribution. White Sulphur Springs, Greenbrier County, West Virginia; Piedmont region of North and South Carolina and Georgia; near Tallahassee, Leon County, River Junction, Gadsden County, and Rock Cave, Jackson County, Florida; near Selma and Berlin, Dallas County, Alabama; Vevay, Switzerland County, and near the Ohio River, Jefferson County, Indiana; not common. Passing into the var. *amphiloba* Sarg., differing from the type in the fascicled hairs on the upper surface of the young leaves and in the often pubescent branchlets; woods in sandy soil near River Junction, Gadsden County, Florida, and Valley Head, DeKalb County, Alabama; and into var. *nivea* Sarg., differing from the type in the white tomentum on the lower surface of the leaves, the glabrous styles, in the tomentum on the lower side of the floral bract when the flowers open, the pubescent gray or pale reddish brown branchlets and in the puberulous winter-buds; deep woods, River Junction, Gadsden County, Florida. More important is

Tilia heterophylla var. Michauxii Sarg.

Tilia Michauxii Nutt.

Leaves ovate to ovate-oblong, acute or abruptly short-pointed at the broad apex, cordate, obliquely cordate, or rarely obliquely truncate at base, and coarsely serrate with apiculate teeth, pubescent above when they unfold with caducous fascicled hairs, and hoary-tomentose beneath, and at maturity thin, dark green and lustrous on the upper surface and coated below with short white or grayish white tomentum, $3\frac{1}{2}'$–$6'$ long and $3\frac{1}{2}'$–$5'$ wide, with a slender yellow midrib and primary veins usually without axillary tufts; petioles slender, sparingly villose when they first appear, soon glabrous, $1\frac{1}{2}'$–$2\frac{1}{2}'$ in length. **Flowers** $\frac{1}{3}'$ long, opening about the 1st of July, on slender puberulous pedicels $\frac{1}{4}'$ in length, in wide long-stemmed puberulous cymes; peduncle pubescent, becoming glabrous, the free portion $1\frac{3}{4}'$–$2'$ in length, its bract obovoid, rounded or acute at apex, $3\frac{1}{2}'$–$5'$ long and $\frac{1}{2}'$–$1'$ wide, decurrent to within $\frac{1}{3}'$–$\frac{3}{4}'$ of the base of the peduncle; sepals ovate, acuminate, ciliate on the margins, puberulous on the outer surface, tomentose on the inner surface, $\frac{1}{4}'$ long, shorter than the lanceolate acuminate petals; staminodia oblong-obovoid, rounded or emarginate at apex; style glabrous. **Fruit** ripening in September, subglobose, rusty-tomentose, $\frac{1}{4}'$–$\frac{1}{3}'$ in diameter.

A large tree with slender glabrous light red-brown branchlets. **Winter-buds** ovoid, acute, slightly flattened, red, about $\frac{1}{4}'$ in length. **Bark** of the trunk $1'$ thick, deeply furrowed, reddish or grayish brown and covered with small thin scales.

Distribution. Pennsylvania, valley of the Susquehanna River (Lancaster County) to

Fig. 672

southern and western New York and through southern Ohio, Indiana, and Illinois to northeastern Missouri (near Ilasco, Ralls County), and southward through eastern Kentucky and Tennessee to northeastern Mississippi, and along the Appalachian Mountains to northern Georgia; southern Georgia (Dougherty and Decatur Counties), Dallas County, Alabama; southwestern Missouri (Eagle Rock, Barry County), and northwestern Arkansas (Eureka Springs, Carroll County, and Cotter, Marion County).

14. Tilia monticola Sarg.

Tilia heterophylla Sarg., in part, not Vent.

Leaves thin, gradually narrowed and acuminate at apex, ovate to oblong-ovate, very oblique and truncate or obliquely cordate at base, finely serrate with straight or incurved apiculate teeth, smooth, dark green and lustrous on the upper surface, thickly coated on the lower surface with hoary tomentum, 4′–7′ long and 3′–5′ wide; petioles slender, glabrous,

Fig. 673

$1\frac{1}{2}$′–3′ in length. **Flowers** from the middle to the end of July, $\frac{2}{5}$′–$\frac{1}{2}$′ long, on stout sparingly pubescent pedicels, in mostly 7–10-flowered thin-branched glabrous cymes; peduncle slender, glabrous, the free portion $1\frac{1}{3}$′–$1\frac{1}{2}$′ in length, its bract gradually narrowed and cuneate or rounded at base, narrowed and rounded at apex, glabrous, 4′–$5\frac{1}{2}$′ long and $\frac{4}{5}$′–1′ wide, decurrent to within $\frac{1}{24}$′–$\frac{1}{8}$′ of the base of the peduncle; sepals ovate, acute, ciliate on the margins, covered on the outer surface with short pale pubescence and with silky white hairs on the inner surface: petals lanceolate, acuminate, twice longer than the sepals; staminodia oblong-lanceolate, rounded at the narrowed apex, as long or nearly as long as the petals; style clothed at the base with long white hairs. **Fruit** ripening in September, ovoid to ellipsoid, covered with pale rusty tomentum, $\frac{1}{4}$′–$\frac{1}{3}$′ long and about $\frac{1}{4}$′ in diameter.

A tree rarely exceeding 60° in height with a trunk 3°–$4\frac{1}{2}$° in diameter, slender branches forming a narrow rather pyramidal head, and stout glabrous branchlets usually bright red during their first year, becoming brown in their second season. **Winter-buds** compressed, ovoid, acute or rounded at apex, light red, covered with a glaucous bloom, $\frac{1}{3}$′–$\frac{1}{2}$′ long. **Bark** of the trunk $\frac{3}{5}$′ in thickness, deeply furrowed, the surface broken into small thin light brown scales.

Distribution. Appalachian Mountains at altitudes usually from 2500°–3000°, Farmer Mountain, on New River, Connell County, Virginia, to Johnson City, Washington County, Tennessee, and to Highlands, Macon County, North Carolina.

15. Tilia georgiana Sarg.

Leaves ovate, abruptly short-pointed at apex, slightly unsymmetric and usually cordate on lateral branches and often oblique or truncate on leading branches at base, and finely dentate with glandular teeth pointing forward, when they unfold deeply tinged with red, covered above by fascicled hairs and tomentose below, when the flowers open the middle of June dark yellow-green, dull and scabrate above and covered below with a thick coat of tomentum, pale on those of lower branches and tinged with brown on those from the top

of the tree, and conspicuously reticulate-venulose, and at maturity thick, dull yellow-green, pubescent or glabrous above, rusty or pale tomentose below, sometimes becoming

Fig. 674

nearly glabrous in the autumn, $2\frac{1}{2}'$–$4'$ long and $2'$–$3'$ wide; petioles slender, tomentose, $1'$–$1\frac{1}{2}'$ in length. **Flowers** $\frac{1}{4}'$–$\frac{1}{3}'$ long, on slender pubescent pedicels, in compact slender-branched pubescent mostly 10–15-flowered corymbs; peduncle slender, densely pubescent, the free portion $1'$–$1\frac{1}{2}'$ in length, its bract oblong to obovate, rounded at apex, rounded or cuneate at base, pubescent, becoming nearly glabrous, $2\frac{1}{2}'$–$4'$ long and $\frac{3}{4}'$–$1\frac{1}{2}'$ wide, decurrent to the base or to within $1'$ of the base of the peduncle; sepals ovate, acuminate, coated on the outer surface with pale pubescence and on the inner surface with pale hairs longest and most abundant at the base, not more than one-half the length of the lanceolate acuminate narrow petals; staminodia oblong-obovate to spatulate, acute, about two-thirds as long as the petals; style glabrous or furnished with a few hairs at the very base. **Fruit** ripens early in September on pubescent pedicels, depressed-globose, occasionally slightly grooved and ridged, covered with thick rusty tomentum, $\frac{1}{5}'$–$\frac{1}{4}'$ in diameter.

A small tree, with slender branchlets thickly coated during their first season with pale tomentum, and dark red-brown or brown and puberulous in their second year. **Winter-buds** covered with rusty brown pubescence, $\frac{1}{4}'$–$\frac{1}{3}'$ long.

Distribution. Coast of South Carolina, near Charleston; Colonel's Island near the mouths of the North Newport and Medway Rivers, near Dunham, Liberty County, and at Brunswick, Glynn County, Georgia, to central and western Florida; Magnet Cove, Hot Spring County, Arkansas (*E. J. Palmer*).

Tilia georgiana var. crinita Sarg.

Tilia pubescens Sarg., in part, not Vent.

Differing in the longer and more matted usually rusty brown hairs of the pubescence, usually less closely attached to the under surface of the leaves and often conspicuous on the young branches.

A tree, 30°–40° high, with a trunk rarely exceeding $15'$ in diameter, and slender branchlets densely rusty pubescent during their first season, and during their third year becoming glabrous, red-brown, rugose and marked by occasional small lenticels. **Winter-buds** acuminate, dark reddish brown and covered with short reddish pubescence. **Bark** of the trunk $\frac{1}{2}'$–$\frac{3}{4}'$ thick, furrowed and divided into parallel ridges, the red-brown surface broken into short thick scales.

Fig. 675

Distribution. Sandy woods near Bluffton, Beaufort County, and in the neighborhood of Charleston, South Carolina, and on Colonel's Island near the mouth of the North Newport and Medway Rivers, near Dunham, Liberty County, Georgia.

XL. STERCULIACEÆ.

Trees or shrubs, with bitter astringent juice, mucilaginous bark, and alternate simple leaves, with stipules. Flowers perfect, regular; calyx of 5 sepals, imbricated in the bud; corolla 0 (in *Fremontia*); anthers extorse; pistil of 5 united carpels; ovary 5-celled; styles united; ovules anatropous.

A family of about fifty genera mostly confined to the tropics. Its most important species, *Theobroma Cacao* L., of the West Indies, produces chocolate from the cotyledons. *Firmiana simplex* F. N. Meyer, of this family and a native of southern China, is often planted as an ornamental tree in the southern states, where it has sometimes become naturalized, and in California.

1. FREMONTIA Torr.

A tree or shrub, with stellate pubescence and naked buds. Leaves broad-ovate, lobed, thick, prominently veined, usually rufous on the lower surface, persistent; stipules minute, deciduous. Flowers solitary, terminal or opposite the leaves, pedicellate, subtended by 3 or rarely 5 minute caducous bracts; calyx subcampanulate, hypogynous, deeply 5-lobed, the lobes imbricated in the bud, petaloid, yellow, spreading, obovate, often mucronate, 1′ long, the 3 outer a little smaller than the others, pubescent on the outer surface, with a hairy cavity at the base of the inner surface; corolla 0; stamens 5; filaments alternate with the sepals, united to the middle into a column; anthers oblong-linear, incurved at the ends, 2-celled, the cells opening longitudinally; ovary 5-celled, the cells opposite the sepals; style filiform, elongated, terminated by an acute undivided stigmatic point; ovules numerous in each cell, horizontal. Fruit an ovoid acuminate 4 or 5-valved loculicidally dehiscent capsule densely coated with long matted hairs, the inner surface of the cells villose-pubescent. Seeds oval; seed-coat crustaceous, puberulous, with a small fleshy marginal deciduous ariloid appendage on the chalaza; embryo straight, in thick fleshy albumen; cotyledons oblong, foliaceous, three or four times longer than the short radicle.

Fremontia, named in honor of John C. Frémont, the distinguished explorer of western North America, is represented by a single species.

1. Fremontia californica Torr. Slippery Elm.

Fremontodendron californicum Cov.

Leaves usually 3-lobed, rarely entire or sometimes 5–7-lobed, $1\frac{1}{2}'$ in diameter; petioles stout, $\frac{1}{2}'-\frac{2}{3}'$ in length. **Flowers** appearing in July in great profusion on short spur-like lateral branchlets. **Fruit** 1′ long; **seeds** very dark red-brown, about $\frac{3}{16}'$ long.

A tree, 20°–30° high, with a short trunk 12′–14′ in diameter, stout rigid branches spreading almost at right angles, and stout terete branchlets thickly coated when they first appear with rufous pubescence, becoming glabrous and light red-brown; more often a low intri-

Fig. 676

cately branched shrub. **Bark** of the trunk rarely more than $\frac{1}{4}'$ thick, deeply furrowed, the dark red-brown surface broken into numerous short thick scales. **Wood** hard, heavy, close-grained, dark brown tinged with red, with thick lighter colored sapwood. The mucilaginous inner bark is sometimes used domestically in poultices.

Distribution. Lower slopes of the California mountains; western base of Mt. Shasta to the San Pedro Mártir Mountains, Lower California; nowhere common west of the Sierra Nevada, but of its largest size on their western foothills; most abundant east of the Sierra Nevada in the region of the Mohave Desert, growing as a low shrub and sometimes forming thickets several acres in extent.

Occasionally cultivated in western and southern Europe as an ornamental plant.

XLI. THEACEÆ.

Trees or shrubs, with simple alternate leaves, without stipules. Flowers perfect, regular, hypogynous; sepals and petals 5, imbricated in the bud; stamens numerous; anthers 2-celled, the cells opening longitudinally; pistil of 3–5 united carpels; ovary 3–5-celled; styles as many as the cells of the ovary, partly united. Fruit capsular; embryo with large cotyledons.

The Camellia family with eighteen genera is principally confined to the tropics of the New World and to southern and eastern Asia. Two genera are represented in the flora of the southern United States, and of these Gordonia is arborescent. Its most important genus, Camellia of eastern Asia, contains the Tea plant, *Camellia Thea* Link, and several species cultivated for the beauty of their flowers.

1. GORDONIA Ell.

Trees or shrubs, with terete branchlets, with an acuminate terminal bud, slender acuminate naked axillary buds, and watery juice. Leaves pinnately veined, entire or crenate,

subcoriaceous and persistent, or thin and deciduous. Flowers axillary, solitary, long-stalked or subsessile; calyx subtended by 2–5 caducous bracts; sepals unequal, rounded, concave, coriaceous, persistent; petals free or slightly united, obovate, concave, white, deciduous; stamens numerous, filaments short, united at base into a fleshy cup adnate to the base of the petals and inserted with them, or long and inserted directly on the petals; anthers introrse, yellow; ovary sessile; style elongated, erect, 5-lobed at the stigmatic apex; ovules 4–8 in each cell, pendulous in 2 series from its inner angle, collateral, anatropous. Fruit a woody oblong or subglobose 5-celled capsule loculicidally 5-valved, with a persistent axis angled by the projecting placentas. Seeds 2–8 in each cell pendulous, flat, without albumen; seed-coat woody, usually produced upward into an oblong wing; embryo mostly straight or oblique, with oblong flat or oblique cotyledons; radicle short, superior.

Gordonia with sixteen species is confined to the south Atlantic states of North America and to tropical Asia and the Malay Archipelago.

The generic name is in honor of James Gordon (1728–1791), a well-known London nurseryman.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Flowers long-pedicellate; filaments united into a cup; capsule ovoid, the valves not splitting from the base; seeds winged; leaves persistent. 1. **G. Lasianthus** (C).

Flowers subsessile; filaments distinct; capsule globose, the valves septicidally splitting from the base; seeds without wings; leaves deciduous. 2. **G. alatamaha** (C).

1. Gordonia Lasianthus Ell. Bay. Loblolly Bay.

Leaves coriaceous, lanceolate to oblong, acute at apex, gradually narrowed to the cuneate base, finely or remotely crenately serrate, usually above the middle only, dark green, smooth and lustrous, 4′–5′ long and 1½′–2′ wide, persistent; finally turning scarlet and

Fig. 677

dropping irregularly through the year; petioles stout, wing-margined toward the apex, channeled, about ½′ in length. **Flowers** pungently fragrant, about 2½′ in diameter, expanding in July and continuing to open successively during two or three months, on stout red pedicels thickening from below upward, 2½′–3′ long, and usually furnished with 3 or 4 ovate minute subfloral bractlets; sepals ovate to oval, ½′ long, ciliate on the margins with long white hairs, and covered on the outer surface with dense velvety pale lustrous pubescence; petals rounded at apex, gradually contracted at base, silky-puberulent on the back, white, incurved, 1¼′–1½′ long and 1′ broad, stamens united into a shallow fleshy deeply 5-lobed cup pubescent on the inner surface and adnate to the base of the petals;

ovary ovoid, pubescent, gradually contracted into the stout style persistent on the fruit. **Fruit** ovoid, acute, pubescent, $\frac{3}{4}'$ long, and $\frac{1}{2}'$ in diameter, splitting to below the middle; **seeds** winged, nearly square, slightly concave on the inner surface and rounded on the outer surface, rugose, dotted with small pale brown excrescences, nearly $\frac{1}{16}'$ long and half the length of the thin membranaceous oblique pale brown wing pointed or rounded at apex; embryo filling the cavity of the seed, nearly straight; cotyledons subcordate, foliaceous.

A short-lived tree, 60°–75° high, with a tall straight trunk 18′–20′ in diameter, small branches growing upward at first and ultimately spreading into a narrow compact head, and dark brown rugose branchlets marked during several years by the horizontal slightly obcordate leaf-scars; or rarely a low shrub. **Winter-buds** $\frac{1}{4}'$–$\frac{1}{3}'$ long, and covered with pale silky lustrous pubescence. **Bark** of the trunk nearly 1′ thick, deeply divided into regular parallel rounded ridges, their dark red-brown scaly surface broken into many irregular shallow furrows. **Wood** light, soft, close-grained, not durable, light red, with lighter colored sapwood of 40–50 layers of annual growth; occasionally used in cabinet-making.

Distribution. Shallow swamps and moist depressions in Pine-barrens; South Carolina (Camden, Kershaw County, and Bluffton, Beaufort County) southward near the coast to the shores of Indian River on the east coast and to Cape Romano on the west coast of Florida, ranging to the interior of the peninsula from Lake to De Soto Counties, and westward along the Gulf coast to southern Mississippi; most abundant in Georgia and east Florida; gradually becoming less abundant westward.

2. Gordonia alatamaha Sarg. Franklinia.

Leaves obovate-oblong, rounded or pointed at apex, gradually narrowed to the long cuneate base, remotely serrate, usually above the middle only, with small glandular teeth, bright green and lustrous on the upper surface, pale on the lower surface, 5′–6′ long and

Fig. 678

$1\frac{1}{2}'$–2′ wide; turning scarlet in the autumn before falling; petioles stout, wing-margined above, $\frac{1}{4}'$–$\frac{1}{2}'$ in length. **Flowers** 3′–$3\frac{1}{2}'$ in diameter, appearing about the middle of September, on short stout pedicels at first pubescent, finally glabrous, from the axils of crowded upper leaves, and marked by the broad conspicuous scars of 2 minute lateral subfloral pubescent bractlets; sepals nearly circular, $\frac{1}{2}'$ in diameter, ciliate on the margins, and covered on the outer surface with short lustrous silky pale hairs; petals obovate, crenulate, white, membranaceous, 1′–$1\frac{1}{2}'$ long and 1′ broad, and densely coated on the outer surface with fine pubescence; filaments distinct, inserted on the petals; ovary conspicuously

ridged, pubescent, truncate, and crowned with a slender deciduous style nearly as long as the stamens. **Fruit** globose, slightly pubescent, $\frac{3}{4}'$ in diameter, the valves splitting nearly to the middle and septicidally from the base to the middle; **seeds** 6–8, or by abortion fewer in each cell, closely packed together on the whole length of the thick axile placenta, nearly $\frac{1}{2}'$ long, angled by mutual pressure, without wings.

A tree, 15°–20° high, with stout slightly angled dark red-brown branchlets covered with small pale oblong horizontal lenticels, and conspicuously marked by large prominent obcordate leaf-scars, with a marginal row of large fibro-vascular bundle-scars. **Winter-buds** compressed, reddish brown, puberulous, $\frac{1}{4}'$–$\frac{1}{3}'$ long. **Bark** of cultivated plants smooth, thin, dark brown.

Distribution. Near Fort Barrington on the Altamaha River, Georgia; not seen in a wild state since 1790, and now only known by cultivated plants.

Occasionally cultivated in the eastern states and hardy as far north as eastern New York and occasionally in eastern Massachusetts, and rarely in western and central Europe.

XLII. CANELLACEÆ.

Trees, with pungent aromatic bark, and alternate pellucid-punctate entire penniveined persistent leaves, without stipules. Flowers perfect, regular, cymose; sepals and petals imbricated in the bud; stamens numerous, hypogynous, with filaments united into a tube inclosing the pistil, and narrow extrorse anthers adnate to the tube and longitudinally 2-celled; pistil of 2–3 united carpels; ovary free, 1-celled, with 2–5 parietal placentas; styles thick; stigmas 2–5-lobed; ovules 2 or many. Fruit a berry; seeds 2 or several; seed-coat thick, crustaceous; embryo small in fleshy oily albumen.

The Wild Cinnamon family with five genera and a few species is confined to tropical America, south Africa and Madagascar, one species reaching the shores of southern Florida.

1. CANELLA P. Br.

A tree, with scaly bark, stout ashy gray branchlets conspicuously marked by large orbicular leaf-scars, and minute buds. Leaves obovate, rounded or slightly emarginate at apex, gradually narrowed to the cuneate base, petiolate, coriaceous. Flowers small, in many-flowered subcorymbose terminal or subterminal panicles of several dichotomously branched cymes from the axils of upper leaves or from minute caducous bracts; sepals 3, suborbicular, concave, coriaceous, erect, their margins ciliate, persistent; petals 5, hypogynous, in a single row on the slightly convex receptacle, oblong, concave, rounded at apex, fleshy, twice as long as the sepals, white or rose color; stamens about 20, staminal tube crenulate at the summit and slightly extended above the anthers; ovary cylindric or oblong-conic, 1-celled, with 2 parietal placentas; style short, fleshy, terminating in a 2 or 3-lobed stigma; ovules numerous, arcuate, horizontal or descending, attached by a short funicle, imperfectly anatropous; micropyle superior. Fruit globose or slightly ovoid, fleshy, minutely pointed with the base of the persistent style, 2–4-seeded. Seeds reniform, suspended; seed-coat black and shining; embryo curved in the copious albumen; cotyledons oblong; radicle next the hilum.

The genus consists of a single West Indian species, extending into southern Florida and to Venezuela.

The generic name is from *canella*, the diminutive of the Latin *cana* or *canna*, a cane or reed, first applied to the bark of some Old World tree from the form of a roll or quill which it assumed in drying.

1. Canella Winterana Gærtn. Cinnamon Bark. White Wood. Wild Cinnamon.

Leaves contracted into a short stout grooved petiole, $3\frac{1}{2}'$–$5'$ long and $1\frac{1}{2}'$–$2'$ wide, bright green and lustrous. **Flowers** about $\frac{1}{8}'$ in diameter, opening in the autumn. **Fruit** ripening in March and April, bright crimson, soft and fleshy, $\frac{1}{2}'$ in diameter; **seeds** about $\frac{3}{16}'$ long.

A tree, in Florida 25°–30° high, with a straight trunk 8′–10′ in diameter, and slender

horizontal spreading branches forming a compact round-headed top. **Bark** of the trunk $\frac{1}{8}'$ thick, light gray, broken on the surface into numerous short thick scales rarely more than 2′–3′ long and about twice as thick as the pale yellow aromatic inner bark. **Wood**

Fig. 679

very heavy, exceedingly hard, strong, close-grained, dark red-brown, with thick light brown or yellow sapwood of 25–30 layers of annual growth. The bitter acrid inner bark is the wild cinnamon bark of commerce. It has a pleasant cinnamon-like odor and is an aromatic stimulant and tonic.

Distribution. Florida, region of Cape Sable, Monroe County (Flamingo [*A. A. Eaton*], East Cape, Madeira Hammock), and widely distributed on the southern keys, usually growing in the shade of other trees; on the Bahama Islands and many of the Antilles.

XLIII. KŒBERLINIACEÆ.

An intricately branched almost leafless tree or shrub, with thin red-brown scaly bark, stout alternate glabrous branchlets covered with pale green bark and terminating in a sharp rigid straight or slightly curved spine. Leaves minute, early deciduous, alternate, narrow-obovate, rounded at apex. Flowers perfect, on slender club-shaped puberulous pedicels from the axils of minute scarious deciduous bracts, in short umbel-like racemes below the end of the branches; calyx of 3 or 5 minute sepals imbricated in the bud, deciduous; petals 4, convolute in the bud, hypogynous, obovate or oblong, subunguiculate, white, much longer than the sepals; disk 0; stamens 8, free, hypogynous, as long as the petals; filaments thickened in the middle, subulate at the ends; anthers oval, attached on the back near the base, 2-celled, the cells opening longitudinally; ovary ovoid, 2-celled, contracted at base into a short stalk and above into a simple subulate style; stigma terminal, obtuse, slightly emarginate; ovules numerous, aduate in several series to the fleshy placenta, horizontal or dependent, anatropous. Fruit a 2-celled berry, black at maturity, subglobose, tipped with the remnants of the pointed style; flesh thin and succulent, the cells 1 or 2-seeded by abortion. Seed vertical, circinate-cochleate; seed-coat crustaceous, slightly rugose, striate; albumen thin; embryo annular; cotyledons semiterete; the radicle ascending.

The family is represented by a single genus.

1. KŒBERLINIA Zucc.

Characters of the family.

Kœberlinia with one species is North American.

The generic name is in honor of L. Koeberlin, a German botanist.

1. Kœberlinia spinosa Zucc.

Leaves not more than $\frac{1}{8}'$ long. **Flowers** appearing in May and June, about $\frac{1}{4}'$ in diameter. **Fruit** $\frac{3}{16}'$–$\frac{1}{4}'$ in diameter.

A bushy tree, rarely 20°–25° high, with a short stout trunk sometimes 6°–8° long and a foot in diameter; more often a low branching shrub forming impenetrable thickets often of considerable extent. **Wood** very hard, heavy, close-grained, dark brown somewhat streaked with orange, becoming almost black on exposure, with thin yellow or nearly white sapwood of 12–15 layers of annual growth.

Distribution. Dry gravelly mesas and foothills; valleys of the upper Colorado River

Fig. 680

(Big Springs, Howard County), and of the lower Rio Grande, Texas, westward through southern Texas and New Mexico to southern Arizona, and southward through northern Mexico, and in Lower California (San Jorge).

XLIV. CARICACEÆ.

Trees or shrubs, with bitter milky juice, and alternate long-petiolate persistent simple or digitately compound leaves, without stipules. Flowers unisexual or perfect, the perianth of the male and female flowers dissimilar; stamens in two series, inserted on the corolla; filaments free; anthers introrse. Fruit baccate.

The Pawpaw family with two genera is tropical American and Mexican, a single representative of the family reaching the shores of southern Florida.

1. CARICA L.

Short-lived trees, with erect simple or rarely branched stems composed of a thin shell of soft fibrous wood surrounding a large central cavity divided by thin soft cross partitions at the nodes, and covered with thin green or gray bark marked by the ring-like scars of fallen leaf-stalks, and stout soft fleshy roots. Leaves simple, palmately lobed or digitate, crowded toward the top of the stem and branches, large, flaccid, subpeltately palmately nerved, and usually deeply and often compoundly lobed. Flowers regular, monœcious or polygamo-diœcious, white, yellow, or greenish white, in axillary cymose panicles, the staminate elongated, pedunculate, and many-flowered, the pistillate abbreviated and few or usually 3-flowered, generally unisexual and diœcious, occasionally polygamo-diœcious, each flower in the axil of a minute ovate acute bract; calyx minute, 5-lobed, the lobes alternate with the petals; corolla of the staminate flower salverform, gamopetalous, the tube elongated, 5-lobed, the lobes oblong or linear, contorted in the bud; stamens 10; filaments free, those of the outer row alternate with the lobes of the corolla and elongated, the others alternate with them and abbreviated; anthers 2-celled, erect, opening longitudinally, often surmounted by their slightly elongated connective; ovary rudimentary, subulate; pistillate

flower, calyx minute, 5-lobed, persistent under the fruit; corolla polypetalous, petals 5, linear-oblong, erect, ultimately spreading above the middle, deciduous; ovary free, sessile, 1-celled or more or less spuriously 5-celled; style 0 or abbreviated; stigmas 5, linear, radiating, dilated and subpalmately lobed at apex; ovules indefinite, inserted in two rows on the placenta, anatropous, long-stalked; micropyle superior; raphe ventral; hermaphrodite flower, corolla gamopetalous, tubular-campanulate, the lobes erect and spreading or subreflexed; stamens 10, in 2 ranks, or 5; ovary obovoid-oblong, longer than the tube of the corolla, more or less spuriously 5-celled below. Fruit slightly 5-lobed, 1-celled or more or less completely 5-celled, filled with soft pulp, many-seeded, that produced from the hermaphrodite flower long-stalked, pendulous, usually unsymmetric, gibbous, and smaller than that from the pistillate flower. Seeds ovoid, inclosed in membranaceous silvery white sac-like arils, occasionally germinating within the fruit; seed-coat crustaceous, closely investing the membranaceous inner coat, the outer coat becoming thick, rugose, succulent, and ultimately dry and leathery; embryo in the axis of fleshy albumen; cotyledons ovate, foliaceous, compressed, longer than the terete radicle turned toward the minute pale subbasilar hilum.

Carica with about twenty species is distributed from southern Florida through the West Indies to southern Brazil and Argentina, and from southern Mexico to Chili. One species grows probably indigenously in Florida. The milky juice of Carica contains papain, which has the power of digesting albuminous substances, and the leaves are often used in tropical countries to make meat tender.

The generic name is formed from the Carib name of one of the species.

1. Carica Papaya L. Pawpaw.

Leaves ovate or orbicular, deeply parted into 5–7 lobes divided more or less deeply into acute lateral lobes, these secondary divisions entire or rarely lobed, the lowest lobes form-

Fig. 681

ing a deep basal sinus, thin, flaccid, yellow-green, 15′–24′ in diameter, with broad flat yellow or orange-colored primary veins radiating from the end of the petiole through the lobes, and small secondary veins extending to the point of the lateral lobes and connected by conspicuous reticulate veinlets; petioles stout, yellow, hollow, enlarged and cordate at base, sometimes becoming 3°–4° in length before the leaves fall. **Flowers** often beginning to appear on plants only 3° or 4° high and a few months old, produced continuously throughout the year, the staminate in clusters on slender spreading or pendulous peduncles 4′–12′ long, the pistillate in 1–3-flowered short-stalked cymes; staminate flowers fragrant, filled with nectar, their corolla $\frac{3}{4}$′–$1\frac{1}{4}$′ long, with a slender tube and acute lobes; anthers

oblong, orange-colored, surmounted by the rounded thickened end of the connective, those of the inner row almost sessile and one third larger than those of the outer row, shorter than their flattened filaments covered, like the connectives, with long slender white hairs; pistillate flowers about 1′ long, with erect petals, without staminodia; ovary ovoid, ivory-white, slightly and obtusely 5-angled, 1-celled, and narrowed into a short slender style crowned by a pale green stigma divided to the base into 5 radiating lobes dilated and 3-nerved at apex. **Fruits** hanging close together against the stem at the base of the leaf-stalk, obovoid to ellipsoid, and obtusely short-pointed, yellowish green to bright orange color; in southern Florida not more than 4′ long and 3′ thick, and usually smaller, with a thick skin closely adherent to the sweet insipid flesh forming a thin layer outside the central cavity; **seeds** full and rounded, about $\frac{3}{16}$′ long; outer portion of the seed-coat rugose at first when the fruit is fully grown but still green, ivory-white, very succulent, and usually separable from the smooth paler chestnut-brown lustrous interior portion, the outer part turning black as the fruit ripens and becoming adherent to the inner portion closely investing the thin lustrous light red-brown inner coat.

A short-lived tree, in Florida attaining a height of 12°–15°, with a trunk seldom more than 6′ in diameter; in the West Indies and other tropical countries often twice as large, with a trunk occasionally dividing into a number of stout upright branches. **Bark** thin, light green, becoming gray toward the base of the stem.

Distribution. Florida from the southern shores of Bay Biscayne on the west coast and of Indian River on the east coast to the southern keys, growing sparingly in rich hummocks; common in all the West Indian islands, in southern Mexico, and in the tropical countries of South America; now naturalized in most of the warm regions of the world, where it is universally cultivated for its fruit, which is considered one of the most wholesome of all tropical fruits, and has been much improved by selection.

XLV. CACTACEÆ.

Succulent trees or shrubs, with copious watery juice, numerous spines springing from cushions of small bristles (*areolæ*), and minute caducous alternate leaves, or leafless. Flowers large and showy, perfect, usually solitary; calyx of numerous spirally imbricated sepals forming a tube, those of the inner series petal-like; corolla of numerous imbricated petals, in many series; stamens inserted on the tube of the calyx, very numerous, in several series, with slender filaments and introrse 2-celled oblong anthers, the cells opening longitudinally; pistil of several united carpels; ovary 1-celled, with several parietal placentas; styles united, terminal; stigmas as many as the placentas; ovules numerous, horizontal, anatropous. Fruit a fleshy berry. Seeds numerous, with albumen; cotyledons foliaceous; radicle turned toward the hilum.

The Cactus family with twenty genera and a very large number of species is most abundant in the dry region adjacent to the boundary of the United States and Mexico, with a few species ranging northward to the northern United States and southward to the West Indian islands, Brazil, Peru, Chili and the Galapagos Islands. Two of the genera have arborescent representatives in the flora of the United States.

CONSPECTUS OF THE ARBORESCENT GENERA OF THE UNITED STATES.

Branches and stems columnar, ribbed, continuous; leaves 0; flower-bearing and spine-bearing areolæ distinct; flowers close above spine-bearing areolæ; tube of the flower elongated; seeds dark-colored. **1. Cereus.**

Branches jointed, tuberculate; leaves scale-like; flower-bearing and spine-bearing areolæ not distinct; tube of the flower short and cup-shaped; seeds pale. **2. Opuntia.**

1. CEREUS Haw.

Trees or shrubs, with columnar ribbed stems, and buds on the back of the ridges from the axils of latent leaves, geminate, superposed, the upper producing a branch or flower, the

lower arrested and developed into a cluster of spines surrounded by an elevated cushion or areola of chaffy tomentose scales. Flowers lateral, elongated, the calyx-lobes forming an elongated tube, those of the outer ranks adnate to the ovary, scale-like, only their tips free, those of the inner ranks free, elongated; petals cohering by their base with the top of the calyx-tube, larger than its interior lobes, spreading, recurved; stamens numerous; filaments adnate by their base to the tube of the calyx, those of the interior ranks free, the exterior united into a tube; style filiform, divided into numerous radiating linear branches stigmatic on the inner face; stalks of the ovules long and slender, becoming thick and juicy in the fruit. Seeds with very thin albumen; embryo straight; cotyledons abbreviated, hooked at apex; radicle conic.

Cereus with at least two hundred species inhabits the dry southwestern region of North America, the West Indies, tropical South America, and the Galapagos Islands. Of the numerous species found within the territory of the United States only one assumes the habit and size of a tree. The fruit of several species is edible, and the ribs of the durable woody frames of the stems of the large arborescent species are used for the rafters of houses and for fuel. Many of the species are planted in warm dry countries in hedges to protect cultivated fields, and others are popular garden plants valued for their beautiful flowers, which are sometimes nocturnal and exceedingly fragrant.

The generic name relates to the candle-like form of the stem of some of the species.

1. Cereus giganteus Engelm. Suwarro.

Leaves 0. **Flowers** 4′–4½′ long and 2½′ wide, opening from May to July in great numbers near the top of the stem, each surrounded on the lower side by the radial spines of the cluster below it; ovary ovoid, 1′ long, rather shorter than the stout tube of the flower, and covered,

Fig. 682

like the base of the tube, by the thick imbricated green outer scale-like sepals, with small free triangular acute scarious mucronate tips, furnished in their axils with short tufts of rufous hairs and occasionally with clusters of chartaceous spines, gradually passing into thin oblong-ovate or obovate larger sepals, mucronate or rounded at apex and closely imbricated in many ranks; petals 25–35, obovate-spatulate, obtuse, entire, thick and fleshy, creamy white, ⅔′ long and much reflexed after anthesis; stamens, with linear anthers emarginate at the ends, and filaments united for half their length to the walls of the calyx-tube, those of the exterior rows joined below into a long tube, surrounding the stout columnar style glandular at base and divided at apex into 12–15 green stigmas. **Fruit** ripening in August, ovoid or slightly obovoid, 2½′ long and 1⅓′ wide, truncate and covered at apex by the depressed pale scar left by the falling of the flower, light red at maturity, separating into 3 or 4

fleshy valves bright red on their inner surface and inclosing the bright scarlet juicy mass of the enlarged funiculi and innumerable seeds; seeds obovoid, rounded, $\frac{1}{6}'$ long, lustrous, dark chestnut-brown.

A tree, 50°–60° high, with a trunk sometimes 2° in diameter, thickest below the middle and tapering gradually toward the ends, marked by transverse superficial lines into rings 4′–8′ long, representing the amount of annual longitudinal growth, 8–12-ribbed at base with obtuse ribs 4′–5′ broad, and at summit 18–20-ribbed with obtuse deep compressed ribs, branchless or furnished above the middle with a few, usually 2 or 3, stout alternate or sometimes opposite upright branches shorter but otherwise resembling the principal stem composed of a thick tough green epidermis, a fleshy covering 3′–6′ thick saturated with bitter juice, and a circle of bundles of woody fibres making, with annual layers of exogenous growth, dense tough elastic columns placed opposite the depressions between the ribs, $\frac{1}{2}'$–3′ in diameter and frequently united by branches growing at irregular intervals between them, the woody frame remaining standing after the death of the plant and the decomposition of its fleshy covering. Areolæ pale, elevated, about $\frac{1}{2}'$ in diameter, bearing clusters of stout straight spines with a large dark fulvous base, sulcate or angled, tinged with red, with thick stout spines in the centre of each cluster, the 4 basal horizontal or slightly inclined downward, the lowest being the longest and stoutest and sometimes $1\frac{1}{2}'$ long and $\frac{1}{12}'$ thick, the upper shorter, more slender and slightly turned upward, with a row of shorter and thinner radial spines 12–16 in number surrounding the central group. Wood of the columns strong, very light, rather coarse-grained, with numerous conspicuous medullary rays, and light brown tinged with yellow; almost indestructible in contact with the ground, little affected by the atmosphere and largely used for the rafters of houses, for fences, and by Indians for lances, bows, etc. The fruit is consumed in large quantities by Indians.

Distribution. Low rocky hills and dry mesas of the desert; valley of the San Pedro River through central and southern Arizona to the valley of the Colorado River between Needles and Yuma, Yuma County, Arizona, and southward in Sonora.

2. OPUNTIA Adans.

Trees or usually shrubs, in the arborescent species of the United States with subcylindric or clavate articulate tuberculate branches, covered with small sunken stomata, and containing tubular reticulated woody skeletons, and thick fleshy or fibrous roots. Leaves scale-like, terete, subulate, caducous, bearing in their axils oblong or circular cushion-like areolæ of chaffy or woolly scales terminal on the branches and furnished above the middle with many short slender slightly attached sharp barbed bristles and toward the base with numerous stout barbed spines surrounded in some species, except at apex, by loose papery sheaths. Flowers diurnal, lateral, produced from areolæ on branches of the previous year between the bristles and spines, sessile, cup-shaped; sepals flat, erect, deciduous; corolla rotate; petals obovate, united at base, spreading; stamens shorter than the petals; filaments free or slightly united below; anthers oblong; style cylindric, longer than the stamens, obclavate below, divided at apex into 3–8 elongated or lobulate lobes stigmatic on the inner face. Fruit sometimes proliferous, covered by a thick skin, succulent and often edible, or dry, pyriform, globose or ellipsoid, concave at apex, surmounted by the marcescent tube of the flower, tuberculate, areolate, or rarely glabrous, truncate at base, with a broad umbilicus at apex. Seeds immersed in the pulpy placentas, compressed, discoid, often margined with a bony raphe; testa pale, bony, sometimes marked by a narrow darker marginal commissure; embryo coiled around the copious or scanty albumen; cotyledons large; radicle thin, obtuse.

Opuntia with many species is distributed from southern New England southward in the neighborhood of the coast to the West Indies, and through western North America to Chili, Brazil, and Argentina, the largest number of species occurring near the boundary of the United States and Mexico. Of the species of the United States at least three attain the size and habit of small trees. Cochineal is derived from a scale-insect which feeds on the

juices of some of the Mexican species, and the fruit of several species is refreshing and is consumed in considerable quantities in semitropical countries. The large-growing species with flat branches are employed in many countries to form hedges for the protection of gardens and fields; and the branches saturated with watery juice are sometimes stripped of their spines and bristles and fed to cattle.

Opuntia is the classical name of some plant which grew in the neighborhood of the city of Opus in Bœotia.

CONSPECTUS OF THE ARBORESCENT SPECIES OF THE UNITED STATES.

Tubercles of the branches full and rounded below the areolæ.

Joints pale olive color, easily separable, their tubercles broad, mammillate; spines yellow; flowers pink; fruit proliferous, usually spineless, often sterile. 1. **O. fulgida** (H).

Joints green or purple, their tubercles narrow, ovoid; spines white to reddish brown; flowers purple; fruit yellow, sparingly spinescent, rarely proliferous. 2. **O. spinosior** (H).

Tubercles of the branches not full and rounded below the areolæ; joints elongated, dark green or purple, their tubercles elongated; spines brown or reddish brown; flowers green, tinted with red or yellow; fruit green, spinescent, rarely proliferous. 3. **O. versicolor** (H).

1. Opuntia fulgida Engelm. Cholla.

Leaves light green, gradually narrowed to the acuminate apex, $\frac{1}{2}'$–$1'$ long. **Flowers** appearing from June to September, the earliest from tubercles at the end of the branches of the previous year the others from the terminal tubercles of the immature fruit developed from the earliest flowers of the season, $1'$ in diameter when fully expanded, with ovaries nearly $1'$ long, 8–10 obtuse crenulate sepals, 5 erect stigmas, and 8 light pink petals, those of the outer ranks cuneate, retuse, crenulate on the margins, shorter than the lanceolate acute petals of the inner ranks, the whole strongly reflexed at maturity. **Fruit** proliferous,

Fig. 683

oval, rounded, $1'$–$1\frac{1}{4}'$ long and nearly as broad, more or less tuberculate, conspicuously marked by large pale tomentose areolæ bearing numerous small bristles, usually spineless or occasionally armed with small weak spines, hanging in pendulous clusters usually of 6 or 7 and occasionally of 40–50 fruits in a cluster, one growing from the other in continuous succession, the first the largest and containing perfect seeds, the others frequently sterile, dull green when fully ripe, with dry flesh, falling usually during the first winter or occasionally persistent on the branches during the second season, and then developing flowers from the tubercles; **seeds** compressed, thin, very angular, $\frac{1}{12}'$–$\frac{1}{6}'$ in diameter.

A tree, with a more or less flexuous trunk occasionally 12° in height and sometimes a foot in diameter, a symmetric head of stout wide-spreading branches and thick pendulous joints sometimes almost hidden by the long conspicuous spines and beginning to develop their woody skeletons during their second or occasionally during their third season, the terminal or ultimate joints ovoid or ovoid-cylindric, tumid, crowded at the end of the limbs, pale olive color, 3′–8′ long, often 2′ in diameter, with broad ovoid-oblong tubercles, $\frac{1}{2}$′–$\frac{3}{4}$′ in length. **Areolæ** of pale straw-colored tomentum and short slender pale bristles, each areola bearing at first 5–15 stout stellate-spreading light yellow spines of nearly equal length, $\frac{3}{4}$′–1′ long and inclosed in loose lustrous sheaths, additional spines developing in succeeding years at the upper margin of the areolæ, the tubercles of old branches being sometimes furnished with from 40–60 spines persistent on the branches for 4–6 years. **Bark** of the trunk and of the large limbs about $\frac{1}{4}$′ thick, separating freely on the surface into large thin loosely attached scales varying in color from brown to nearly black on the largest stems, and unarmed, the spines mostly falling with the outer layers from branches 3′–4′ thick. **Wood** of old trunks light, hard, pale yellow, with broad conspicuous medullary rays, well marked layers of annual growth, and a thick pith.

Distribution. Plains of Arizona south of the Colorado plateau, and in the adjacent region of Sonora; not rare; apparently most abundant and of its largest size in the United States on the mesas near Tucson, Pima County, at altitudes between 2000° and 3000°.

2. Opuntia spinosior Toumey. Tassajo.

Leaves terete, tapering gradually to the setulose apex, about $\frac{1}{4}$′ long, remaining on the branches from four to six weeks. **Flowers** opening in April and May and remaining open

Fig. 684

for two or three days, 2′–2$\frac{1}{2}$′ in diameter, with ovaries about 1′ long, obovate sepals, broad-obovate dark purple petals, sensitive red stamens, and a 6–9-parted stigma. **Fruits** clustered at the end of the branches of the previous year, persistent during the winter and occasionally during the following summer and then sometimes proliferous, oval or rarely globose or hemispheric, frequently 2′ long and 1$\frac{1}{2}$′ thick, with yellow acrid flesh and 20–30 tubercles very prominent during the summer, nearly disappearing as the fruit ripens and enlarges, leaving it marked only by the small oval areolæ covered with short bristles, and bearing numerous slender spines deciduous in December as the fruit begins to turn yellow; **seeds** nearly orbicular, slightly or not at all beaked, $\frac{1}{6}$′–$\frac{1}{5}$′ in diameter, and marked by linear conspicuous commissures.

A tree, with an erect trunk occasionally 10° high and 5′–10′ in diameter, numerous stout spreading limbs forming an open irregular head, and branches with joints 4′–12′ long and

$\frac{3}{4}'$–1′ thick, covered with a thick epidermis varying from green to purple, and usually developing woody skeletons during their second season, their tubercles prominent, compressed, ovoid, $\frac{1}{3}'$–$\frac{1}{2}'$ long. **Areolæ** oval, clothed with pale tomentum and short light brown bristles, their spines 5–15 on the tubercles of young joints and 30–50 on those of older branches, and slender, white to light reddish brown, closely invested in white glistening sheaths, stellate-spreading, $\frac{1}{2}'$–$\frac{3}{4}'$ long, those in the interior sometimes considerably longer than the radial spines. **Bark** of the trunk and of the larger limbs about $\frac{1}{4}'$ thick, spineless, nearly black, broken into elongated ridges, and finally much roughened by numerous closely appressed scales. **Wood** light, soft, pale reddish brown, and conspicuously reticulate, with conspicuous medullary rays and well defined layers of annual growth; sometimes used in the manufacture of light furniture, canes, picture-frames, and other small articles.

Distribution. Widely scattered over the mesas of southern Arizona south of the Colorado plateau and of the adjacent regions of Sonora.

3. Opuntia versicolor Coult.

Leaves terete, abruptly narrowed to the spinescent apex, $\frac{1}{3}'$–$\frac{1}{2}'$ long, persistent on the branches from four to six weeks. **Flowers** opening in May, about $1\frac{1}{2}'$ in diameter, with ovaries $\frac{5}{8}'$ long, broad-ovate acute sepals, and narrow obovate petals rounded above and green tinged with red or with yellow. **Fruit** usually clavate, 2′–$2\frac{1}{2}'$ long, nearly $1\frac{1}{2}'$ in diameter, with areolæ generally only above the middle and usually furnished with 1–3 slender reflexed persistent spines about $\frac{1}{2}'$ long, or occasionally spineless, rarely nearly spherical and only about $\frac{3}{4}'$ in diameter, ripening from December to February, and at maturity the same color as the joint on which it grows, usually withering, drying, and splitting open on the tree, or remaining fleshy and persistent on the branches until the end of the following summer, and sometimes through a second winter, or often becoming imbedded in the end of a more or less elongated joint; **seeds** irregularly angled, with narrow commissures.

A tree, with an erect trunk occasionally 6°–8° high and 8′ in diameter, numerous stout irregularly spreading or often upright branches, and cylindric terminal joints generally

Fig. 685

6′–12′ but sometimes 2° in length, $\frac{3}{4}'$–1′ in diameter, and covered with a thick dark green or purple epidermis, marked by linear flattened tubercles, their woody skeletons usually formed during their second season. **Areolæ** large, oval, clothed with gray wool, generally bearing a cluster of small bristles, and slender stellate-spreading brown or reddish brown spines, with close early deciduous straw-colored sheaths, 4–14 and on old tubercles 20–25 in number, the inner 1–4 in number, usually deflexed and unequal in length, the longest about

$\frac{1}{3}'$ long and longer than the radial spines. Bark of the trunk and of the large branches smooth, light brown or purple, usually unarmed, $\frac{1}{2}'$–$\frac{3}{4}'$ thick, finally separating into small closely appressed black scales. Wood reticulate, hard, compact, light reddish brown and rather lustrous, with thin conspicuous medullary rays, well-defined layers of annual growth, and thick pale or nearly white sapwood.

Distribution. Foothills and low mountain slopes of southern Arizona and northern Sonora; very abundant.

XLVI. RHIZOPHORACEÆ.

Glabrous trees or shrubs, with terete branchlets, and usually opposite coriaceous entire persistent leaves, with interpetiolar stipules. Flowers in axillary clusters; calyx-lobes valvate in the bud, persistent; petals inserted on the tube of the calyx and as many as its lobes; stamens inserted at the base of a conspicuous disk; anthers 2-celled, the cells opening longitudinally; pistil of 2–5 united carpels; ovary 2–5-celled; ovules usually 2 in each cell, suspended from its apex, collateral, anatropous; raphe ventral; micropyle superior. Fruit usually indehiscent, 1-celled and 1-seeded.

The Mangrove family is tropical, with most of its seventeen genera confined to the Old World.

1. RHIZOPHORA L. Mangrove.

Trees, with pithy branchlets, thick astringent bark, and adventitious fleshy roots. Leaves ovate or elliptic, glabrous, petiolate; stipules elongated, acuminate, infolding the bud, caducous. Flowers perfect, yellow or creamy white, sessile or pedicellate, bibracteolate, the bractlets united into an involucral cup, in pedunculate dichotomously or trichotomously branched clusters, the base of their branches surrounded by an involucre of 2 ovate 3-lobed persistent bracts, or 1-flowered; calyx 4-lobed, the lobes acute, coriaceous, ribbed on the inner surface and thickened on the margins, two or three times longer than the turbinate globose tube, reflexed at maturity, persistent; petals 4, induplicate in the bud, alternate with and longer than the calyx-lobes, inserted on a fleshy disk-like ring in the mouth of the calyx-tube, involute on the margins, coated on the inner surface with long pale hairs, or flat and naked, caducous; stamens 8–12; filaments short or 0; anthers attached at the base, introrse, elongated, connivent, areolate; ovary partly inferior, conic, 2-celled, contracted into two subulate spreading styles stigmatic at apex. Fruit a conic coriaceous berry surrounded by the reflexed calyx-lobes and perforated at the apex by the germinating embryo. Seed germinating in the fruit before falling, the apex surrounded by a thin albuminous cup-like aril; seed-coat thick and fleshy; embryo surrounded by a thin layer of albumen; cotyledons dark purple; radicle elongated, clavate, and when fully grown separating from the narrow exserted woody tube inclosing the plumule and developed from the cotyledons after the ripening of the fruit.

Rhizophora with three species is widely and generally distributed on the shores of tidal marshes in the tropical regions of the two hemispheres, one specie reaching those of southern Florida. It possesses astringent properties; the bark has been used in tanning leather, in dyeing, and as a febrifuge. The wood is hard, durable, and dark-colored. By means of the aerial germination of its seeds and in its power to develop roots from trunks and branches, Rhizophora is especially adapted to maintain itself on low tidal shores and is an important factor in protecting and extending them into the ocean. Roots springing from the stems at a considerable distance above the ground and arching outward descend into the water and fix themselves in the mud beneath, while roots growing down from the branches enter the ground and gradually thicken into stems. The fully grown radicle ready to put forth roots and leaves, and often 10′–12′ long, is thicker and heavier at the root end than at the other, and in detaching itself from the cotyledons and in falling the heavy end sticks in the mud, while the plumule at the other end, held above the shallow surface of the water, soon unfolds its leaves.

The generic name, from ῥίζα and φέρειν, was used by early authors to designate various climbing plants with thickened roots.

1. Rhizophora Mangle L.

Leaves ovate or elliptic, rounded or acute at apex, gradually narrowed at base, dark green and very lustrous on the upper surface, paler on the lower surface, $3\frac{1}{2}'$–$5'$ long and $1'$–$2'$ wide, with slightly thickened margins, a broad midrib, and reticulate veinlets; persistent for one or two years; petioles $\frac{1}{2}'$–$1\frac{1}{2}'$ in length; stipules lanceolate, acute, $1\frac{1}{2}'$ long, deciduous as the leaf unfolds. **Flowers** produced through the year, $1'$ in diameter, pedicellate, in

Fig. 686

2 or 3-flowered clusters on peduncles $1\frac{1}{2}'$ long from the axils of young leaves; petals pale yellow, coated on the inner surface with long pale hairs; stamens 8 with villose filaments. **Fruit** $1'$ long, rusty brown, slightly roughened by minute bosses, the hard woody thick-walled tube developed from the cotyledons protruding $\frac{1}{2}'$–$\frac{2}{3}'$ from its apex after the germination of the seed, covering the plumule, and holding the dark brown radicle marked with occasional orange-colored lenticels and when fully grown $10'$–$12'$ long and $\frac{1}{4}'$–$\frac{1}{3}'$ thick near the apex.

A round-topped bushy tree, with spreading branches usually 15°–20° high, forming almost impenetrable thickets with its numerous aerial roots, or occasionally 70°–80° high, with a tall straight trunk clear of branches for more than half its length, a narrow head, and stout glabrous dark red-brown branchlets, becoming lighter colored in their second year and then conspicuously marked by large oval slightly elevated leaf-scars. **Bark** of young stems and of the branches smooth, light reddish brown, becoming on old trunks $\frac{1}{3}'$–$\frac{1}{2}'$ thick, and gray faintly tinged with red, the surface irregularly fissured and broken into thin appressed scales. **Wood** exceedingly heavy, hard, close-grained, strong, dark reddish brown streaked with lighter brown, with pale sapwood of 40–50 layers of annual growth; used for fuel and wharf-piles.

Distribution. Shores of Florida from Indian River on the east coast and shores of Tampa Bay on the west coast to the southern keys; most abundant south of latitude 29°, following the coast with wide thickets and ascending the rivers for many miles; on Cape Sable and the shores of Bay Biscayne sometimes growing at a little distance from the coast on ground not submerged by the tide, and here attaining its largest size, with tall straight trunks and few aerial roots; on Bermuda, the Bahamas, the Antilles, the west coast of Mexico, lower California, the Galapagos Islands, and from Central America along the northeast coast of South America to the limits of the tropics.

XLVII. COMBRETACEÆ.

Trees or shrubs, with astringent juice, naked buds, and alternate or opposite simple entire coriaceous persistent leaves, without stipules. Flowers regular, perfect, or polyg-

amous; calyx 5-lobed, the lobes valvate in the bud; petals 5, valvate in the bud, inserted at the base of the calyx, or 0; disk epigynous; stamens 5–10, inserted on the limb of the calyx; filaments slender, filiform, distinct, exserted; anthers introrse, 2-celled, the cells opening longitudinally; ovary 1-celled; style slender, subulate; stigma minute, terminal, entire; ovules usually 2, suspended from the apex of the cell, collateral, anatropous; raphe ventral; micropyle superior. Fruit drupaceous, often crowned with the accrescent calyx. Seed solitary; albumen 0; embryo straight, with convolute cotyledons; radicle minute, turned toward the hilum.

Of the fifteen genera of this family, widely distributed through the tropics, three have arborescent representatives in southern Florida.

CONSPECTUS OF THE ARBORESCENT GENERA OF THE UNITED STATES.

Corolla 0; leaves alternate.

Calyx persistent; flowers in spikes; seeds without wings. **1. Bucida.**

Calyx deciduous; flowers in capitate heads; seeds winged. **2. Conocarpus.**

Corolla of 5 petals; calyx persistent; leaves opposite. **3. Laguncularia.**

1. BUCIDA L.

A tree or shrub, with terete often spinescent branchlets. Leaves crowded at the end of spur-like lateral branchlets much thickened and roughened by the large elevated crowded leaf-scars, alternate, obovate to oblong-lanceolate, rounded and slightly emarginate or minutely apiculate at apex, gradually narrowed and cuneate at base, coriaceous, bluish green on the upper surface and yellow-green on the lower surface, pubescent while young, especially beneath, and glabrous at maturity with the exception of rufous hairs on the under surface of the stout midrib, and on the short stout petiole. Flowers perfect, greenish white, hairy on the outer surface, sessile in the axils of minute bracts, in lax elongated axillary clustered rufous-pubescent spikes; calyx-tube ovoid, constricted above the ovary, the limb campanulate, 5-lobed, the lobes valvate in the bud, persistent; petals 0; stamens 10, in two ranks, inflexed in the bud, unequal, 5 longer than the others and inserted opposite the calyx-lobes under the hairy 5-lobed disk, the others shorter, alternate with them and inserted higher on the calyx-tube; filaments incurved near the apex; anthers minute, sagittate; ovary included in the tube of the calyx; style thickened and villose at the base; ovules suspended on an elongated slender funiculus. Fruit ovoid, conic, oblique, and more or less falcate, irregularly 5-angled, coriaceous, light brown, puberulous on the outer surface, with thin membranaceous flesh inseparable from the crustaceous stone porous toward the interior. Seed ovoid, acute; seed-coat coriaceous, chestnut-brown; cotyledons fleshy; radicle superior.

Bucida with a single species is confined to tropical America, where it is distributed from southern Florida and the Bahama Islands through the West Indies to Guiana and Central America.

The generic name is from *βοῦς*, in allusion to the fancied resemblance of the fruit to the horns of an ox.

1. Bucida Buceras L. Black Olive-tree.

Leaves 2′–3′ long, 1′–1½′ wide, their petioles ⅓′–½′ in length. **Flowers** appearing in Florida in April, ⅛′ long, on spikes 1½′–3′ in length. **Fruit** about ½′ long.

A tree, with a single straight trunk, or often with a short prostrate stem 2°–3° in diameter, producing several straight upright secondary stems 40°–50° high and 12′–18′ in diameter, stout branches spreading nearly at right angles with the trunk and forming a broad head, and branchlets clothed when they first appear with short pale rufous pubescence mostly persistent for two or three years, becoming light reddish brown and covered with bark separating into thin narrow shreds. **Bark** of the trunk and of the large branches thick, gray tinged with orange-brown, and broken into short appressed scales. **Wood** exceedingly heavy, hard, close-grained, light yellow-brown sometimes slightly streaked

Fig. 687

with orange, with thick clear pale yellow sapwood of 30–40 layers of annual growth. The bark has been used in tanning leather.

Distribution. Florida, only on Elliott's Key; widely distributed in brackish marshes through the West Indies to the shores of the Caribbean Sea and the Bay of Panama.

2. CONOCARPUS L.

A tree or shrub, with angled branchlets. Leaves alternate, short-petiolate, narrow-ovate or obovate, acute, gradually contracted and biglandular at base, glabrous or sericeous. Flowers perfect, minute, in dense capitate heads in narrow leafy terminal panicles, with acute caducous bracts and bractlets coated with pale hairs, on stout hoary-tomentose peduncles bibracteolate near the middle; calyx-tube truncate, obliquely compressed at base, clothed with pale hairs, the limb campanulate, parted to the middle, the lobes ovate, acute, erect, pubescent on the outer and puberulous on the inner surface, deciduous; petals 0; disk 5-lobed, hairy; stamens usually 5, inserted in 1 rank, or rarely 7 or 8 in 2 ranks; anthers cordate, minute; style thickened and villose at base. Fruits scale-like, broad-obovoid, pointed, recurved, and covered at apex with short pale hairs, densely imbricated in ovoid reddish heads; flesh coriaceous, corky, produced into broad lateral wings; stone thin-walled, crustaceous, inseparable from the flesh. Seed irregularly ovoid; seed-coat membranaceous, pale chestnut-brown.

The genus consists of a single species of tropical America and Africa.

The generic name, from *χῶνος* and *καρπὸς*, is in allusion to the cone-like shape of the heads of fruits.

1. Conocarpus erecta L. Buttonwood.

Leaves slightly puberulous on the lower surface when they first appear or coated with pale silky persistent pubescence (var. *sericea*, DC.), 2′–4′ long, ½′–1½′ wide, lustrous, dark green or pale on the upper surface, paler on the lower surface, with a broad orange-colored midrib, obscure primary veins, and reticulate veinlets; petioles stout, broad, ½′ in length. **Flowers** produced throughout the year, in heads ⅓′ in diameter on peduncles ½′–1½′ in length, in panicles 6′–12′ long. Cone of fruit about 1′ in diameter.

A tree, 40°–60° high, with a trunk 20′–30′ in diameter, small branches forming a narrow regular head, and slender branchlets conspicuously winged, light red-brown, usually glabrous, or silky pubescent (var. *sericea*, DC.), becoming terete and marked by large orbicular leaf-scars in their second year; or sometimes a low shrub, with semiprostrate stems. **Bark** of the trunk dark brown, divided by irregular reticulating fissures into broad flat ridges broken on the surface into small thin appressed scales. **Wood** very heavy, hard,

strong, close-grained, dark yellow-brown, with thin darker colored sapwood of about 10 layers of annual growth; burning slowly like charcoal and highly valued for fuel. The

Fig. 688

bark is bitter and astringent, and has been used in tanning leather, and in medicine as an astringent and tonic.

Distribution. Low muddy tide-water shores of lagoons and bays: Florida, Cape Canaveral and shores of Tampa Bay to the southern keys; of its largest size in Florida on Lost Man's River near Cape Sable; at its northern limits a low shrub; common on the Bahama Islands, in the Antilles, on the shores of Central America and tropical South America, on the Galapagos Islands, and on the west coast of Africa.

3. LAGUNCULARIA Gærtn.

A tree, with scaly bark, terete pithy branchlets, and naked buds. Leaves opposite, glabrous, thick and coriaceous, oblong or elliptic, obtuse or emarginate at apex, marked toward the margin with minute tubercles; their petioles conspicuously biglandular. Flowers usually perfect or polygamo-monœcious, minute, flattened, greenish white, sessile, in simple terminal axillary tomentose spikes generally collected in leafy panicles, with ovate acute hoary-tomentose bracts and bractlets; calyx-tube turbinate, with 5 prominent ridges opposite the lobes of the limb and 5 intermediate lesser ridges, furnished near the middle with 2 minute appendages, and coated with dense pale tomentum, the limb urceolate, 5-parted to the middle, the divisions triangular, obtuse or acute, erect, persistent; disk epigynous, flat, 10-lobed, the 5 lobes opposite the petals broader than those opposite the calyx-lobes, hairy; petals 5, nearly orbicular, contracted into a short claw inserted on the bottom of the calyx-limb, ciliate on the margins, caducous; stamens 10, inserted in 2 ranks; anthers cordate, apiculate; ovary 1-celled; style short, crowned with a slightly 2-lobed capitate stigma. Fruit 10-ribbed, coriaceous, hoary-pubescent, elongated, obovoid, flattened, crowned with the calyx-limb, unequally 10-ribbed, the 2 lateral ribs produced into narrow wings, 1-seeded; flesh coriaceous, corky toward the interior, inseparable from the thin-walled crustaceous stone dark red and lustrous on the inner surface. Seed suspended, obovoid or oblong; seed-coat membranaceous, dark red; radicle elongated, slightly longer and nearly inclosed by the green cotyledons.

Laguncularia consists of a single species of tropical America and Africa.

The generic name is from *laguncula*, in allusion to the supposed resemblance of the fruit to a flask.

1. Laguncularia racemosa Gærtn. Buttonwood. White Mangrove.

Leaves slightly tinged with red when they unfold, and at maturity dark green on the upper and lighter green or pale on the lower surface, $1\frac{1}{2}'$–$2\frac{1}{2}'$ long and $1'$–$1\frac{1}{2}'$ wide; petioles

red, $\frac{1}{2}'$ in length. **Flowers** $\frac{1}{4}'$ long, in hoary-tomentose spikes produced throughout the year from the axils of young leaves and $1\frac{1}{2}'$–$2'$ long. **Fruit** about $\frac{1}{2}'$ long.

A tree, 30°–60° high, with a trunk 12′–20′ in diameter, stout spreading branches forming a narrow round-topped head, and slender glabrous branchlets somewhat angled at first, often marked with minute pale spots and dark red-brown, becoming in their second year terete, light reddish brown or orange color, thickened at the nodes, and marked by conspicuous ovate leaf-scars; or northward in Florida a low shrub. **Bark** of the trunk $\frac{1}{4}'$ thick,

Fig. 689

brown slightly tinged with red, the surface broken into long ridge-like scales. **Wood** heavy, hard, strong, close-grained, dark yellow-brown, with lighter colored sapwood of 10–12 layers of annual growth. The bark contains a large amount of tannic acid and is sometimes used in tanning leather, and is astringent and tonic.

Distribution. Muddy tidal shores of bays and lagoons; southern Florida from Manatee County on the west coast and Brevard County on the east coast to the southern keys; common and of its largest size in Florida on the shores of Shark River, Monroe County; common in Bermuda, the Bahamas, the Antilles, tropical Mexico and Central America, tropical South America and western Africa.

XLVIII. MYRTACEÆ.

Trees or shrubs abounding in pungent aromatic volatile oil, with minute scaly buds. Leaves opposite, simple, mostly entire, pellucid-punctate, penniveined, persistent, the slender obscure veins arcuate and united within the thickened revolute margins; stipules 0. Flowers perfect, regular; calyx 4–5-lobed, the lobes imbricated in the bud, or lid-like and deciduous; petals 2–5, imbricated in the bud, inserted on the margin of the disk, or 0; stamens very numerous, inserted in many ranks with the petals; filaments slender, inflexed in the bud, exserted; anthers introrse, 2-celled, the cells opening longitudinally; ovary 2–4-celled; style simple, filiform, crowned with a minute stigma; ovules numerous or 2 or 3 in each cell, attached on a central placenta, anatropous or semianatropous; raphe ventral; micropyle superior. Fruit baccate, crowned with the persistent calyx-lobes, 1–4-seeded. Seeds without albumen; seed-coat membranaceous.

The Myrtle family with seventy-four genera is chiefly tropical and Australasian, with representatives in southern Europe, extratropical Africa, and extratropical South America. Two genera are represented by small trees in the flora of southern Florida. To this family, beside the Myrtle, belong the Australian Eucalypti, large and important timber-trees largely planted in California, and the Guava, cultivated in Florida for its fruit.

CONSPECTUS OF THE ARBORESCENT GENERA OF THE UNITED STATES.

Calyx closed in the bud by a lid-like deciduous limb; petals 0. 1. **Calyptranthes.**
Calyx 4 or 5-lobed with persistent lobes; petals 4 or 5. 2. **Eugenia.**

1. CALYPTRANTHES Sw.

Aromatic trees or shrubs, with terete or angled branchlets. Leaves complanate in the bud, penniveined, petiolate. Flowers minute, in subterminal and axillary pedunculate many-flowered panicles, their primary and secondary branches often racemose, the ultimate branches cymose; calyx-tube turbinate, produced above the ovary, closed in the bud by a slightly 4 or 5-lobed lid-like orbicular limb, opening in anthesis by a circumscissile line, the limb at first attached laterally, finally deciduous; disk lining the tube of the calyx; petals 2–5, minute, or 0; ovary 2 or 3-celled; ovules 2 or 3 in each cell, collateral, ascending, anatropous. Fruit 2–4-seeded. Seed subglobose or short-oblong; seed-coat shining; cotyledons foliaceous, contortuplicate; radicle elongated, incurved.

Calyptranthes with eighty species is confined to tropical America, with two species reaching southern Florida.

The generic name is from χαλύπτρα and ἄνθη, in reference to the peculiar lid-like limb which closes the calyx before the opening of the flower.

CONSPECTUS OF THE ARBORESCENT SPECIES OF THE UNITED STATES.

Leaves acuminate, pubescent below; petioles up to $\frac{1}{2}'$ in length; inflorescence and young branchlets covered with silky rufous tomentum. 1. **C. pallens** (D).
Leaves abruptly pointed or obtuse at apex, glabrous; petioles not more than $\frac{1}{6}'$ in length; inflorescence and young branchlets glabrous. 2. **C. Zuzygium** (D).

1. Calyptranthes pallens Griseb.

Chytraculia Chytraculia Sudw.

Leaves oblong or oblong-ovate, acuminate at apex, gradually narrowed and cuneate at base, pellucid-punctate above, marked with dark glands below, when they unfold pink or light red and covered with pale silky hairs, and at maturity coriaceous, dark green and lustrous on the upper surface, coated with pale pubescence on the lower surface, $2\frac{1}{2}'$–$3'$ long and $\frac{1}{2}'$–$\frac{3}{4}'$ wide, with a broad midrib orange-colored beneath; petioles stout, $\frac{1}{3}'$–$\frac{1}{2}'$ in length.

Fig. 690

Flowers sessile, $\frac{1}{8}'$ long, in long-stalked many-flowered clusters $2\frac{1}{2}'$–$3'$ long and wide, covered like their bracts and the flower-buds with silky rufous pubescence, with slender divari-

cate branches, the ultimate divisions 3-flowered; petals 0. **Fruit** short-oblong or nearly globose, dark reddish brown and puberulous, with thin dry flesh; seeds short-oblong, rounded at the ends.

A tree, in Florida 20°–25° high, with a trunk 3′–4′ in diameter, small branches forming a narrow head, and slender branchlets at first wing-angled between the nodes and coated with short rufous silky tomentum, becoming in their second or third year terete, thickened at the nodes, light gray tinged with red and covered with small thin scales. **Bark** of the trunk about $\frac{1}{8}$′ thick, with a generally smooth light gray or almost white surface occasionally separating into irregular plate-like scales. **Wood** very heavy, hard, close-grained, brown tinged with red, with lighter colored sapwood of 30–40 layers of annual growth.

Distribution. Florida, shores of Lake Worth, in the neighborhood of Bay Biscayne, Dade County, and on Big Pine Key, Elliott's Key, Key Largo and Key West; on the Bahama Islands, on many of the Antilles and in southern Mexico.

2. Calyptranthes Zuzygium Sw.

Leaves elliptic, abruptly or gradually narrowed into a blunt point or obtuse at apex, cuneate at base, entire, covered with minute pellucid dots, glabrous, dark yellow-green

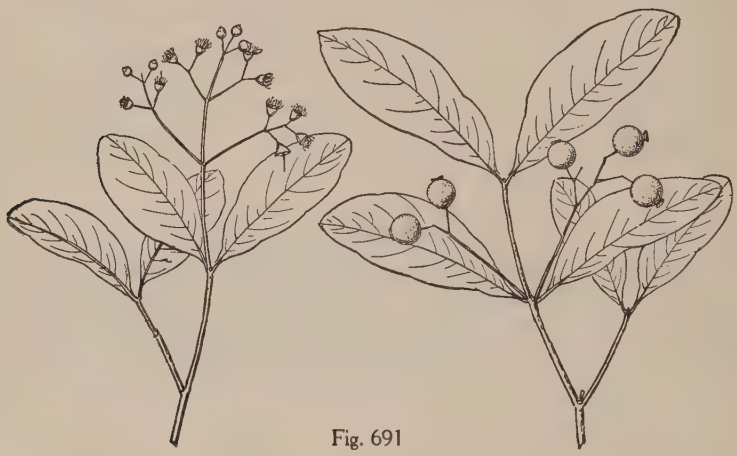

Fig. 691

and lustrous on the upper surface, paler on the lower surface, $1\frac{1}{2}$′–$2\frac{1}{4}$′ long and $\frac{3}{5}$′–$1\frac{1}{4}$′ wide, with a broad low midrib and slender primary veins arcuate and connected within the slightly revolute somewhat undulate margins; petioles deeply grooved, $\frac{1}{8}$′–$\frac{1}{6}$′ in length. **Flowers** on slender pedicels $\frac{1}{6}$′–$\frac{1}{5}$′ long, in axillary 1–3-branched few-flowered axillary cymes $\frac{3}{4}$′ long and $\frac{1}{2}$′ wide, on slender peduncles 1′–$1\frac{1}{4}$′ in length, the ultimate divisions of the inflorescence 1–3-flowered; petals wanting; style rather longer than the stamens. **Fruit** about $\frac{1}{3}$′ in diameter.

A tree, in Florida sometimes 40° high, with a tall trunk 4′ or 5′ in diameter, covered with smooth pale gray bark, small branches and slender terete ascending ashy gray branchlets.

Distribution. Florida, Paradise and Long Keys in the Everglades, Dade County; on the Bahama Islands and in Cuba, Jamaica and Hayti.

2. EUGENIA L.

Trees or shrubs, with hard durable wood and scaly bark. Flowers often large and conspicuous, on short bibracteolate pedicels, in axillary racemes or fascicles or dichotomously branched cymes, with minute caducous bracts and bractlets; calyx campanulate, scarcely

produced above the ovary, the limb 4 or rarely 5-lobed; petals usually 4, free and spreading; ovary 2 or rarely 3-celled; ovules numerous in each cell, semianatropous. Fruit 1–4-seeded. Seeds globose or flattened; seed-coat membranaceous or cartilaginous; embryo thick and fleshy; cotyledons thick, more or less conferruminate into a homogeneous mass; radicle very short, turned toward the hilum.

Eugenia with some five hundred species is common in all tropical regions, with eight species reaching the shores of southern Florida, of these 6 are small trees. Several species are valued for their stimulant and digestive properties; some produce useful timber or edible fruit, and others are cultivated for the beauty of their flowers. Cloves are the flower-buds of *Eugenia aromatica* Baill., a native of the Molucca Islands; and *Eugenia Jambos* L., the Rose Apple, of southeastern Asia, is cultivated in all tropical countries as a shade-tree and for its delicately fragrant fruit.

The generic name commemorates the interest in botany and gardening taken by Prince Eugène of Savoy, who built the Belvidere Palace near Vienna in the beginning of the eighteenth century, and made a collection of rare plants in its gardens.

CONSPECTUS OF THE ARBORESCENT SPECIES OF THE UNITED STATES.

Flowers in axillary racemes or fascicles.

Flowers in short solitary or clustered axillary racemes.

Leaves ovate or obovate, rounded at apex, short-petiolate; fruit subglobose to short-oblong, black, $\frac{1}{3}'$ in diameter. 1. **E. buxifolia** (C, D).

Leaves ovate, contracted at apex into a broad point, distinctly petiolate; fruit globose, black, $\frac{1}{2}'$ in diameter. 2. **E. axillaris** (C, D).

Flowers in axillary fascicles.

Leaves usually broad-ovate, narrowed at apex into a short point, subcoriaceous; fruit subglobose, rather broader than high, $\frac{2}{3}'$–$1'$ in diameter, becoming black at maturity. 3. **E. rhombea** (D).

Leaves oblong-ovate, narrowed at apex into a long point, coriaceous; fruit subglobose to obovoid, $\frac{1}{4}'$–$\frac{1}{3}'$ long, bright scarlet. 4. **E. confusa** (D).

Flowers in dichotomously branched cymes. (*Anamomis.*)

Leaves ovate or obovate; cymes usually 3-flowered; flowers not more than $\frac{1}{4}'$ in diameter; fruit black. 5. **E. dicrana** (D).

Leaves oblong or broad-elliptic; cymes 3–15-flowered; flowers up to $\frac{1}{2}'$ in diameter; fruit red. 6. **E. Simpsonii** (D).

1. Eugenia buxifolia Willd. Gurgeon Stopper. Spanish Stopper.

Leaves ovate or obovate, rounded at apex, sessile or narrowed into a short thick petiole, occasionally slightly and remotely crenulate-serrate above the middle, thick and coriaceous, dark green on the upper surface, yellow-green and marked with minute black dots on the lower surface, $1'$–$1\frac{1}{2}'$ long and about $1'$ wide, with a narrow conspicuous midrib; usually unfolding in November and remaining on the branches until the end of their second winter, and often turning red or partly red before falling. **Flowers** appearing in Florida from midsummer until early autumn, $\frac{1}{2}'$ in diameter, on short thick pedicels, in short rufous-pubescent racemes clustered in the axils of old or fallen leaves, with minute lanceolate acute persistent bracts, and broad-ovate acute bractlets immediately below the flowers; calyx glandular-punctate, pubescent on the outer surface, with 4 ovate rounded lobes much shorter than the 4 ovate white petals rounded at apex, ciliate on the margins, and glandular-punctate. **Fruit** subglobose to short-oblong, black, glandular-roughened, crowned with the large calyx-lobes, usually 1-seeded, and about $\frac{1}{3}'$ in diameter, with thin aromatic flesh; **seeds** $\frac{1}{3}'$ in diameter, with a thick pale brown lustrous cartilaginous coat and a pale olive-green embryo.

A shrubby tree, in Florida rarely 20° high, with a short trunk occasionally a foot in diameter, small mostly erect branches, and terete slender branchlets coated at first with rufous pubescence, becoming at the end of a few months ashy gray or gray tinged with red,

and often more or less twisted or contorted. **Bark** of the trunk rarely more than $\frac{1}{8}'$ thick, light brown tinged with red, and broken into small thick square scales. **Wood** very heavy,

Fig. 692

exceedingly hard, strong, close-grained, dark brown shaded with red, with thick lighter colored sapwood of 15–20 layers of annual growth; sometimes used for fuel.

Distribution. Florida, Cape Canaveral to the southern keys, and on the west coast from the banks of the Caloosahatchee River to Cape Sable; one of the commonest plants on the keys, forming on coral rock a large part of the shrubby second growth now occupying ground from which the original forest has been removed; on the Bahama Islands and on several of the Antilles.

2. Eugenia axillaris Willd. Stopper. White Stopper.

Leaves ovate, gradually or abruptly narrowed at apex into a short wide point, rounded at the narrowed base, thick and coriaceous, dark green on the upper surface, paler and

Fig. 693

covered with minute black dots on the lower surface, $1\frac{1}{2}'$–$2\frac{1}{2}'$ long and $\frac{1}{2}'$ wide, with a broad midrib deeply impressed above; petioles stout, slightly winged, about $\frac{1}{3}'$ in length.

Flowers appearing at midsummer, about $\frac{1}{8}'$ in diameter, in short axillary racemes, on stout pedicels $\frac{1}{16}'$–$\frac{1}{2}'$ long, covered with pale white hairs, and furnished near the middle or toward the apex with 2 acute minute persistent bractlets; calyx glandular-punctate, covered on the outer surface with pale hairs, 4-lobed, with ovate rounded lobes shorter than the 4 ovate glandular white petals. **Fruit** ripening in succession from November to April, globose, black, glandular-punctate, usually 1-seeded, $\frac{1}{2}'$ in diameter, edible, rather juicy, with a sweet agreeable flavor; **seeds** subglobose, $\frac{1}{4}'$ in diameter, with a pale brown chartaceous coat, and light olive-green cotyledons.

A tree, 20°–25° high, with a trunk occasionally a foot in diameter, small branches, and terete stout rigid ashy gray branchlets often slightly tinged with red and covered with small wart-like excrescences; or toward the northern limits of its range a low shrub. **Bark** of the trunk about $\frac{1}{8}'$ thick and divided by irregular shallow fissures into broad ridges finally separating on the surface into small thin light brown scales. **Wood** heavy, hard, strong, very close-grained, brown often tinged with red, with thin darker colored sapwood of 5–6 layers of annual growth.

Distribution. Florida, shores of the St. John's River to the southern keys; nowhere common; on the Bahama Islands and on several of the Antilles.

3. Eugenia rhombea Kr. & Urb. Stopper.

Leaves broad-ovate, narrowed into a broad point rounded at apex, and abruptly or gradually narrowed and cuneate at base, when they unfold thin and light red, and at maturity

Fig. 694

subcoriaceous, conspicuously marked with black dots, olive-green on the upper surface and paler on the lower surface, 2′–2½′ long and 1′–1½′ wide, with a narrow midrib; unfolding in Florida in May; petioles narrow-winged, $\frac{1}{3}'$–$\frac{1}{2}'$ in length. **Flowers** $\frac{1}{2}'$ in diameter, appearing in Florida in April or May on slender glandular pedicels $\frac{1}{3}'$–$\frac{2}{3}'$ long and furnished at apex with 2 lanceolate acute persistent bractlets ciliate on the margins, in sessile axillary many-flowered clusters; calyx-tube much shorter than the limb divided into 4 glandular narrow lobes rounded at apex and one half the length of the broad-ovate rounded glandular white petals. **Fruit** ripening in Florida from September to November, $\frac{3}{4}'$–1′ in diameter, slightly glandular-roughened, orange color, with a bright red cheek when fully grown, becoming black at maturity; flesh thin and dry; **seeds** almost globose, nearly $\frac{1}{2}'$ in diameter, with a thick pale chestnut-brown lustrous coat and olive-green cotyledons.

A tree, 20°–25° high, with a trunk usually a foot in diameter, small branches, and slender terete branchlets at first light purple and covered with a glaucous bloom, becoming ashy gray or almost white. **Bark** of the trunk about $\frac{1}{16}'$ thick, with a smooth light gray sur-

face slightly tinged with red. **Wood** heavy, hard, close-grained, light brown, with hardly distinguishable sapwood.

Distribution. Florida, Key West and Umbrella Key; on the Bahama Islands and on many of the Antilles.

4. Eugenia confusa DC. Red Stopper.

Leaves oblong-ovate, abruptly or gradually contracted into a long narrow point rounded or acute at apex, cuneate or occasionally rounded at base, thin and light red when they unfold, and at maturity dark green and very lustrous on the upper surface, paler and marked with minute black dots on the lower surface, 1½′–2′ long and ⅓′–⅔′ wide, with a thick orange-colored midrib barely impressed above and prominent reticulate veinlets; petioles stout, about ¼′ in length. **Flowers** barely ⅛′ in diameter, appearing in September on slender pedicels ¼′–½′ long and furnished near the apex with 2 minute acute bractlets, in many-flowered axillary clusters; calyx glandular-punctate, with 4 ovate acute lobes much shorter than the 4 broad-ovate rounded white petals. **Fruit** ripening in March and April, subglobose to obovoid, bright scarlet, ¼′–⅓′ long, glandular-roughened, usually solitary and

Fig. 695

1-seeded, with thin dry flesh; **seed** nearly globose, about ⅛′ in diameter, with a thin crustaceous light brown lustrous coat and an olive-green embryo.

A tree, 50°–60° high, with a straight trunk 18′–20′ in diameter, stout upright branches forming a narrow compact head, and slender terete ashy gray branchlets. **Bark** of the trunk about ⅛′ thick, bright cinnamon-red, separating freely into small thin scales. **Wood** very heavy, exceedingly hard, strong, close-grained, bright red-brown, with thick dark-colored sapwood of 50–60 layers of annual growth.

Distribution. Florida, rich hummocks near the shores of Bay Biscayne, Dade County, and on Old Rhodes and Elliotts Keys; on the Bahama Islands and on several of the Antilles.

5. Eugenia dicrana Berg. Naked Wood.

Anamomis dichotoma Sarg.

Leaves ovate or obovate, acute or rounded and occasionally emarginate at apex, cuneate at base, chartaceous when they unfold, becoming subcoriaceous, glabrous, covered with minute black dots, 1′–1¼′ long and ½′–⅔′ wide, with a stout midrib; petioles stout, enlarged at base, coated at first with silky hairs, finally glabrous. **Flowers** appearing in Florida in May, ¼′ in diameter, in cymes produced near the end of the branches, in the axils of leaves of the year, on slender peduncles coated with pale silky hairs, sometimes 1-

flowered and not longer than the leaves, more often longer than the leaves, dichotomously branched and 3-flowered, with 1 flower at the end of the principal division in the fork of its

Fig. 696

branches, or occasionally 5–7-flowered by the development of peduncles from the axils of the bracts of the secondary divisions of the inflorescence, each branch of the inflorescence furnished immediately beneath the flower with 2 lanceolate acute bractlets nearly as long as the calyx-tube; calyx hoary-tomentose, the lobes ovate, rounded at apex and much shorter than the ovate acute glandular-punctate white petals. **Fruit** ripening in Florida in August, reddish brown, $\frac{1}{4}'$ long, obliquely oblong, obovate or subglobose, roughened by minute glands; flesh thin, rather dry and aromatic; **seeds** reniform, light brown, exceedingly fragrant.

A tree, 20°–25° high, with a trunk 6′–8′ in diameter, and slender terete branchlets light red and coated with pale silky hairs when they first appear, becoming glabrous in their second year and covered with light or dark brown bark separating into small thin scales; or often a shrub, with numerous slender stems. **Bark** of the trunk $\frac{1}{16}'$–$\frac{1}{8}'$ thick, with a smooth light red or red-brown surface separating into minute thin scales. **Wood** very heavy, hard, close-grained, light brown or red, with thick yellow sapwood of 40–50 layers of annual growth.

Distribution. Florida, rocky woods, Mosquito Inlet to Cape Canaveral on the east coast, and from the banks of the Caloosahatchee River to the shores of Cape Romano on the west coast, on Key West, and in the neighborhood of Bay Biscayne, Dade County; on the Bahama Islands and on several of the Antilles.

6. Eugenia Simpsonii Sarg.

Anamomis Simpsonii Small.

Leaves oblong, rounded and abruptly short-pointed or occasionally emarginate at apex, cuneate at base, or broad-elliptic, silky pubescent and ciliate on the margins when they unfold, soon glabrous, and at maturity coriaceous, dark yellow-green and lustrous on the upper surface, paler and dull on the lower surface, $1\frac{1}{2}'$–$2'$ long and $\frac{1}{2}'$–$1'$ wide, with a prominent midrib impressed on the upper side and obscure spreading primary veins united before reaching the thickened revolute entire margins of the leaf; petioles covered at first with snowy white tomentum, soon glabrous, slender, $\frac{1}{8}'$–$\frac{1}{4}'$ in length. **Flowers** fragrant, about $\frac{1}{2}'$ in diameter, sessile in lateral 3–15-flowered cymes on slender finely appressed-pubescent peduncles longer or shorter than the subtending leaves, their bractlets acuminate and $\frac{1}{3}'$ long; calyx-tube short-obconic, thickly covered with silky white hairs, the lobes rounded at apex, green, punctate, two of them orbicular-reniform, the others orbicular-ovate, shorter

than the white concave, obovate to suborbicular erose ciliate sparingly punctate petals. Fruit ellipsoid, red, mostly $\frac{1}{3}'$–$\frac{2}{5}'$ long; seed reniform, usually solitary.

Fig. 697

A tree, occasionally 60°–70° high, with a trunk 15′–16′ in diameter, small erect and spreading smooth gray-brown or reddish brown branches forming a narrow round-topped head, and slender branchlets covered when they first appear with snowy white tomentum, soon glabrous, and bright or dull reddish brown, and marked in their second year with the nearly orbicular elevated conspicuous scars of fallen leaves. Bark of the trunk thin, smooth, reddish, marked by pale blotches.

Distribution. Florida, Arch Creek Hummock north of Little River, and on Paradise and Long Keys in the Everglades, Dade County.

XLIX. MELASTOMACEÆ.

Trees, shrubs, or herbs with watery juice. Leaves opposite, rarely verticellate, 3–9-nerved, usually petiolate; stipules 0. Flowers regular, perfect, usually showy, rarely fragrant, in terminal clusters; calyx usually 4 or 5-lobed, the lobes imbricated in the bud; petals as many as the lobes of the calyx, inserted on its throat, imbricated or convolute in the bud; stamens as many or twice as many as the petals, inserted in 1 series with them, often inclined or declinate; anthers 2-celled, attached at the base, opening by a terminal pore; ovary 2 or many-celled; style terminal, simple, straight or declinate; stigma capitate, simple or lobed; ovules numerous, minute, anatropous. Fruit capsular or baccate, inclosed in the calyx-tube; seeds minute; testa coriaceous or crustaceous; hilum lateral or basal; embryo without albumen.

This family with 164 genera and a large number of species is chiefly confined to the tropics, and is most abundant in those of South America.

1. TETRAZYGIA A. Rich.

Trees or shrubs, with terete branchlets. Leaves opposite, petiolate, oblong-ovate to ovate-lanceolate, entire or denticulate, 3–5-nerved, persistent, scurfy, like the young branchlets, peduncles and calyx-tube. Flowers perfect in many-flowered terminal panicles or corymbs; calyx-tube urceolate or globose, adnate to the ovary, the limb constricted above the ovary and dilated below the apex, the lobes short or elongated; petals obovate, obtuse, convolute in the bud; stamens twice as many as the petals; filaments subulate; anthers linear-subulate, erect or slightly recurved, attached at base, 2-celled, opening by a minute pore at apex, their connective not extended below the cells; ovary 3–6-celled; style filiform, curved, exserted, surrounded at base by a short sheath 8–10-toothed at apex; ovules indefinite, minute, sessile on an axile placenta. Fruit a 3 or 4-celled berry, crowned by the persistent tube of the calyx; seeds numerous, minute, obpyramidal, thickened and

incurved at apex; testa coriaceous, slightly pitted; hilum basal; cotyledons thick; radicle short, turned toward the hilum.

Tetrazygia with 14 species is confined to the West Indies and southern Florida where one species has been discovered, the only tree of the great family of the Melastomaceæ found in the United States.

The generic name is from τέτρα and ζυγόν in allusion to the often 4-parted flowers.

1. Tetrazygia bicolor Cogn.

Leaves oblong-lanceolate, acuminate, gradually narrowed and rounded at base, 3-nerved, entire, undulate and slightly thickened on the revolute margins, dark green on the upper surface, paler on the lower surface, 3′–4½′ long and 1′–1¾′ wide; petioles stout, ¾′–1′ in

Fig. 698

length. **Flowers** appearing from March to May, ⅝′ in diameter, short-stalked, in open cymose panicles; calyx urceolate, 4 or 5-lobed, the lobes nearly obsolete; petals 4 or 5, oblong-obovate, reflexed after anthesis, white; ovary 3-celled, style surrounded at base by a short sheath 10-toothed at apex. **Fruit** ripening in late autumn or early winter, oblong to ovoid, conspicuously constricted at apex, ¼′–⅓′ in length and ⅙′–⅕′ in diameter.

In Florida a shrub, or in the dense woods of the keys of the Everglades a slender tree, often 30° high, with an erect trunk 3′ o. 4′ in diameter, covered with thin light gray-brown slightly fissured bark, small spreading branches becoming erect toward their apex and gracefully drooping leaves; or in the sandy soil of open Pine-woods often less than 3° in height.

Distribution. Florida, on the Everglade Keys, Dade County; on the Bahama Islands and in Cuba.

L. ARALIACEÆ.

Trees, shrubs, or herbs, with watery juice and scaly buds. Leaves alternate, compound or simple, petiolate, with stipules. Flowers in racemose or panicled umbels: parts of the flower in 5's; disk epigynous; ovule solitary, suspended from the apex of the cell, anatropous; raphe ventral, the micropyle superior. Fruit baccate. Seeds, with albumen.

The Aralia family with fifty-four genera is chiefly tropical, with a few genera extending beyond the tropics into the northern hemisphere, especially into North America and eastern Asia. The widely distributed and largely extratropical genus Aralia is represented by

one arborescent species in the flora of the United States. Hedera, the Ivy, of this family, is commonly cultivated in the temperate parts of the United States, and some species of Panax and Acanthopanax from eastern Asia are found in gardens in the northeastern states.

1. ARALIA L.

Aromatic spiny trees and shrubs, with stout pithy branchlets, and thick fleshy roots, or bristly or glabrous perennial herbs. Leaves digitate or once or twice pinnate, the pinnæ serrulate; stipules produced on the expanded and clasping base of the petiole. Flowers perfect, polygamo-monœcious or polygamo-dioecious, on slender jointed pedicels, small, greenish white; calyx-tube coherent with the ovary, the limb truncate, repand or minutely toothed, the teeth valvate in the bud; petals imbricated in the bud, inserted by their broad base on the margin of the disk, ovate, obtuse or acute and slightly inflexed at apex; stamens inserted on the margin of the disk, alternate with the petals; filaments filiform; anthers oblong or rarely ovoid, attached on the back, introrse, 2-celled, the cells opening longitudinally; ovary 2–5-celled; styles 2–5, in the fertile flower distinct and erect or slightly united at base, spreading and incurved above the middle, or incurved from the base and sometimes inflexed at apex, crowned with large capitate stigmas, in the sterile flower short and united. Fruit fleshy, laterally compressed or 3–5-angled, crowned with the remnants of the style; nutlets 2–5, orbicular, ovoid or oblong, compressed, crustaceous, light reddish brown, 1-seeded. Seed compressed; seed-coat thin, light brown, adnate to the thin fleshy albumen; cotyledons ovate-oblong, as long as the straight radicle.

Aralia with forty species is confined to North America and Asia.

The name is of obscure meaning.

1. Aralia spinosa L. Hercules' Club. Prickly Ash.

Leaves clustered at the end of the branches, twice pinnate, 3°–4° long and 2½° wide, with a stout light brown petiole 18′–20′ in length, clasping the stem with an enlarged base and armed with slender prickles, or occasionally unarmed; pinnæ unequally pinnate, usually with 5 or 6 pairs of lateral leaflets and a long-stalked terminal leaflet, and often furnished at base with a pinnate or simple leaflet; leaflets ovate, acute, dentate or crenate, cuneate or more or less rounded at base, short-petiolulate, when they unfold lustrous, bronze-green, and slightly pilose on the midrib and primary veins, and at maturity thin, dark green above, pale beneath, 2′–3′ long and 1½′ wide, with a thin midrib occasionally furnished with small prickles and slender primary veins nearly parallel with their margins; in the autumn turning light yellow before falling; stipules acute, about 1′ long, at first puberulous on the back and ciliate on the margins. **Flowers** $\frac{1}{10}$′ long, appearing at midsummer on long slender pubescent straw-colored pedicels, in many-flowered umbels arranged in compound panicles, with light brown puberulous branches becoming purple in the autumn, forming a terminal racemose cluster 3°–4° long, and rising solitary or 2 or 3 together above the spreading leaves; bracts and bractlets lanceolate, acute, scarious, persistent: petals white, acute, inflexed at apex; ovary often abortive; styles connivent. **Fruit** ripening in autumn, black, $\frac{1}{8}$′ in diameter, globose, 3–5-angled, crowned with the blackened styles, with thin purple very juicy flesh; **seeds** oblong, rounded at the ends, about $\frac{1}{10}$′ long.

A tree, 30°–35° high, with a trunk 6′–8′ in diameter, stout wide-spreading branches, and branchlets ½′–¾′ in diameter, armed like the branches and young trunks with stout straight or slightly incurved orange-colored scattered prickles, and nearly encircled by the conspicuous narrow leaf-scars marked by a row of prominent fibro-vascular bundle-scars, light orange-colored in their first season, lustrous and marked irregularly with oblong pale lenticels, becoming light brown in their second year, with bright green inner bark; more often a shrub, with a cluster of unbranched stems 6°–20° tall. **Winter-buds:** terminal conic, blunt at apex, ½′–¾′ long, with thin chestnut-brown scales; axillary triangular, flattened, about ¼′ long and broad. **Bark** of the trunk dark brown, about ⅛′ thick, and divided by broad shallow fissures into wide rounded ridges irregularly broken on the surface. **Wood** close-grained, light, soft, brittle, brown streaked with yellow, with lighter colored sapwood

Fig. 699

of 2 or 3 layers of annual growth. The bark of the roots and the berries are stimulant and diaphoretic, and are sometimes used in medicine and in domestic practice.

Distribution. Deep moist soil in the neighborhood of streams; southern Pennsylvania to southern Indiana, southeastern Iowa and southeastern Missouri, and southward to northern Florida, western Louisiana, and eastern Texas; probably of its largest size on the foot-hills of the Big Smoky Mountains in Tennessee.

Occasionally cultivated as an ornamental plant in the eastern states and in western Europe; hardy in eastern Massachusetts.

LI. NYSSACEÆ.

Trees or shrubs, with terete branchlets, scaly buds, alternate entire dentate or serrate deciduous leaves, without stipules. Flowers diœcious, polygamo-diœcious or perfect; staminate, calyx minute, 5-toothed or lobed; petals 5 or more, imbricated in the bud, or 0; stamens as many, twice as many, or fewer than the petals, usually in 2 series; filaments sometimes of 2 lengths, elongated, filiform or subulate; disk fleshy, depressed at apex; pistillate flowers, calyx-tube adnate to the ovary; petals 5 or more, imbricated in the bud; ovary 1-celled or 6–10-celled; ovule solitary, pendulous from the apex of the cell, anatropous; micropyle superior; disk epigynous, pulvinate, the apex depressed or convex, or 0; style subulate, curved or spirally involute at apex, or 2-parted, or conic and divided into as many stigmatic lobes as the cells of the ovary. Fruit drupaceous or subsamaroid, crowned with the remnants of the calyx, 1-celled and 1-seeded, or 3–5-celled, the cells thin, 4-seeded; seed pendent, testa membranaceous or thin, albumen fleshy; cotyledons foliaceous or thin; radicle cylindric.

Nyssaceæ with 3 genera, Nyssa L., Camptotheca Decne. and Davidia Baill. and 8 species is confined to eastern North America, western China, Thibet, the Himalayas and the Malay Archipelago.

1. NYSSA L.

Trees, with leaves conduplicate in the bud, petiolate, sometimes remotely angulate or toothed, mostly crowded at the end of the branches. Flowers polygamo-diœcious, minute, greenish white; staminate on slender pedicels from the axils of minute caducous bracts, in simple or compound clusters on long axillary peduncles bibracteolate near the middle or at the apex or sometimes without bractlets; calyx disciform or cup-shaped, the limb 5-toothed; petals 5, imbricated in the bud, equal or unequal, ovate or linear-oblong, thick, inserted on the margin of the conspicuous pulvinate entire or lobed disk, erect; stamens 5–12, exserted;

filaments filiform; anthers oblong; ovary 0; pistillate flowers on axillary peduncles, in 2 or few-flowered clusters, sessile or nearly so, in the axils of conspicuous bracts and furnished with 1 or 2 small lateral bractlets, or solitary and surrounded by 2–4 bractlets; calyx-tube campanulate, sometimes slightly urceolate, the limb 5-toothed; petals small, thick, and spreading; stamens 5–10; filaments short; anthers fertile or sterile; disk less developed than in the staminate flower, depressed in the centre; ovary 1 or 2-celled; style terete, elongated, recurved, stigmatic toward the apex or the inner face; raphe ventral. Fruit drupaceous, short-oblong, fleshy, urceolate at apex; flesh thin, oily, acidulous; stone thick-walled, bony, terete or compressed, ribbed or winged, 1 or rarely 2-celled, usually 1-seeded. Seed filling the cavity of the stone; seed-coat pale; embryo straight.

Nyssa with six species is confined to the eastern United States and to southern and eastern Asia, where one species is distributed from the eastern Himalayas to the island of Java and another occurs in central and western China. The American species produce tough wood, with intricately contorted and twisted grain.

Nyssa, the name of a nymph, was given to this genus from the fact that one of the species grows in water.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Pistillate flowers in 2 or few-flowered clusters, their calyx disciform; fruit blue, not more than ⅔′ long; stone with broad rounded ribs.

Stone indistinctly ribbed; leaves linear-oblong to oval or obovate.
1. **N. sylvatica** (A, C).

Stone prominently ribbed; leaves oblanceolate to oblong or elliptic.
2. **N. biflora** (C).

Pistillate flowers solitary, their calyx cup-shaped; fruit 1′ or more long.

Fruit red; stone with prominent wings; leaves oblong-oval or obovate, usually obtuse at apex.
3. **N. ogeche** (C).

Fruit purple; stone with acute ridges; leaves oval or oblong, acute or acuminate at apex.
4. **N. aquatica** (A, C).

1. Nyssa sylvatica Marsh. Tupelo. Pepperidge. Sour Gum.

Leaves crowded at the end of lateral branchlets or remote on vigorous shoots, linear-oblong, lanceolate, oval or obovate, acute or acuminate or sometimes contracted into a

Fig. 700

short broad point at apex, cuneate or occasionally rounded at base, entire, with slightly thickened margins, or rarely coarsely dentate, coated when they unfold with rufous tomentum, especially on the lower surface, or pubescent or sometimes nearly glabrous, and at

maturity thick and firm, dark green and lustrous above, pale and often villose below, principally along the broad midrib and on the primary veins, 2′–5′ long and ½′–3′ wide; turning early in autumn bright scarlet on the upper surface only; petioles slender or stout, terete or wing-margined, ciliate, ¼′–1½′ in length, and often bright red. **Flowers** appearing in early spring when the leaves are about one third grown on slender pubescent or tomentose peduncles ½′–1½′ long, staminate in many-flowered dense or lax compound heads, pistillate in 2 to several-flowered clusters, sessile in the axils of conspicuous often foliaceous bracts, and furnished with 2 smaller acute hairy bractlets; calyx of the staminate flower disciform; petals thick, ovate-oblong, acute, rounded at apex, erect or slightly spreading, early deciduous; stamens exserted in the staminate flower, shorter than the petals in the pistillate flower; stigma stout, exserted, reflexed above the middle, 0 in the staminate flower. **Fruit** ripening in October, 1–3 from each flower-cluster, ovoid, ⅓′–⅔′ long, dark blue, with thin acrid flesh; **stone** light brown, ovoid, rounded at base, pointed at apex, terete or more or less flattened, and 10–12-ribbed, with narrow indistinct pale ribs rounded on the back.

A tree, with thick hard roots and few rootlets, often surrounded by root-sprouts, occasionally 100° or rarely 125° high, with a trunk sometimes 5° in diameter, numerous slender pendulous tough flexible branches forming a head sometimes short, cylindric and flat-topped, sometimes low and broad, or on trees crowded in the forest narrow, pyramidal or conic, and sometimes inversely conic and broad and flat at the top, and branchlets when they first appear light green to orange color, and in their first winter nearly glabrous or pale or rufous-pubescent, light red-brown marked by minute scattered pale lenticels and by small lunate leaf-scars displaying the ends of 3 conspicuous groups of fibro-vascular bundles, later becoming darker and developing short stout spur-like lateral branchlets; generally in the northern and extreme southern states much smaller, and rarely more than 50°–60° tall. **Winter-buds** obtuse, ¼′ long, with ovate acute apiculate dark red puberulous imbricated scales, those of the inner ranks accrescent, bright-colored at maturity, and marking the base of the branchlet with obscure ring-like scars. **Bark** of the trunk ¾′–1½′ thick, light brown often tinged with red, and deeply fissured, the surface of the ridges covered with small irregularly shaped scales. **Wood** heavy, soft, strong, very tough, not durable, light yellow or nearly white, with thick lighter colored sapwood of 80–100 layers of annual growth; used for the hubs of wheels, rollers in glass factories, ox-yokes, wharf-piles, and sometimes for the soles of shoes.

Distribution. Borders of swamps in wet imperfectly drained soil, and often especially southward on high wooded mountain slopes; valley of the Kennebec River, Maine, to southern Ontario, central Michigan, southern Missouri and eastern Oklahoma, and southward to northern Florida, and to the valley of the Brazos River, Texas; of its largest size on the southern Appalachian Mountains.

Occasionally cultivated as an ornamental tree in the eastern states, but difficult to transplant except when very young. The first tree in the eastern states to assume autumn colors of the leaves.

2. Nyssa biflora Walt.

Leaves oblanceolate, oblong, elliptic or rarely ovate, acute or acuminate or occasionally rounded at the narrow apex, cuneate or rounded at the gradually narrowed base, and entire, when they unfold silky-villose above and hoary-tomentose beneath, soon becoming glabrous, dark yellow-green and lustrous on the upper surface, paler and sometimes glaucous on the lower surface, 2′–4′ long and ¾′–1′ wide, with a prominent midrib and numerous slender veins; petioles stout, ¼′–½′ in length. **Flowers** appearing when the leaves are nearly fully grown; staminate on slender villose pedicels, in many-flowered loose clusters on slender hairy peduncles 1′–1½′ in length; pistillate in pairs on rather stouter peduncles usually about 1′ long; calyx of the staminate flower disciform; petals oblong-ovate, rounded at apex, white, erect or slightly spreading, early deciduous. **Fruit** solitary or in pairs, on peduncles 1′–1½′ in length, oval or ellipsoid, dark blue, lustrous, about ⅓′ long, with acrid pulp; **stone** oval, compressed, narrowed at the ends, and prominently ribbed.

Fig. 701

A tree, rarely more than 30° high, with a slender trunk gradually tapering upward from a swollen and much enlarged base, small spreading branches forming a narrow pyramidal or round-topped head, branchlets slightly villose when they first appear, soon glabrous, bright reddish brown in their first winter, becoming darker the following year, and numerous erect thick roots rising above the surface of the water. **Winter-buds** acute, dark red-brown, puberulous, and about $\frac{1}{8}'$ long, the inner scales hoary-tomentose. **Bark** about 1′ thick, deeply furrowed, gray to very dark reddish brown.

Distribution. Small Pine-barren ponds of the coastal plain from North Carolina to central and eastern Florida, southern Alabama and Mississippi, and western Louisiana (near Lake Charles, Calcasieu Parish).

3. Nyssa ogeche Marsh. Ogeechee Lime. Sour Tupelo.

Leaves oblong, oval or obovate, acute, rounded or rarely obtuse, and apiculate at apex, gradually or abruptly cuneate or sometimes rounded at base, and entire, covered on the lower surface when they unfold with thick hoary tomentum and on the upper surface with short scattered pale hairs, and at maturity thick and firm, dark green, lustrous and slightly pilose above, pale below, 4′–6′ long and 2′–$2\frac{1}{2}'$ wide, with a stout midrib, 9 or 10 pairs of primary veins covered on the lower side with rufous pubescence or often nearly glabrous, and obscure reticulate veinlets; petioles stout, grooved, $\frac{1}{2}'$–1′ in length. **Flowers** appearing in March and April; staminate in capitate clusters on slender hairy peduncles $\frac{1}{2}'$ long, bibracteolate near the middle, and developed from the axils of the inner scales of the terminal bud, covered with long pale hairs on the outer surface of the short obscurely 5-toothed cup-shaped calyx and on the oblong petals rounded at apex; filaments longer than the petals; anthers oval and conspicuously tuberculate-roughened; pistillate solitary, $\frac{1}{10}'$ long, on short stout woolly peduncles from the axils of bud-scales, and furnished at apex with 2 acute hairy bractlets; calyx coated, like the minute rounded spreading petals, with hoary tomentum; stamens included, with short filaments, and small mostly fertile anthers; style stout, exserted, reflexed from near the base. **Fruit** bright or dull red, on slender tomentose stems enlarged at apex and $\frac{1}{2}'$–$\frac{2}{3}'$ long, ripening in July and August, and sometimes persistent on the branches until after the falling of the leaves, oblong or obovoid, 1′–$1\frac{1}{2}'$ in length, tipped with the thickened and pointed remnants of the style; flesh thick, juicy, very acid; **stone** oblong, compressed, narrowed at the ends, rounded at base, acute at apex, with walls produced into 10 or 12 broad thin papery white wings, about 1′ long, and 1 or rarely 2-seeded.

A tree, usually not more than 30° high with one or several stems 2°–3° in diameter, or often only a shrub, and with spreading branches forming a narrow round-topped head, and slender branchlets coated when they first appear with rufous tomentum, light reddish brown

or green tinged with red and puberulous during their first summer, turning gray or reddish brown in their first winter, and marked by large lunate or nearly triangular leaf-scars displaying the ends of 3 groups of fibro-vascular bundles; often a shrub, with numerous slender clustered diverging stems. **Winter-buds** obtuse, $\frac{1}{8}'$ long, with ovate apiculate imbricated scales rounded on the back and clothed with thick hoary tomentum, those of the inner ranks becoming at maturity ovate-oblong or obovate, rounded at apex, bright red, and

Fig. 702

$\frac{1}{2}'$–$\frac{3}{4}'$ long. **Bark** of the trunk about $\frac{1}{8}'$ thick, irregularly fissured, with a dark brown surface broken into thick appressed persistent plate-like scales. **Wood** light, soft, tough, not strong, white, with thin hardly distinguishable sapwood of about 10 layers of annual growth. A preserve with an agreeable subacid flavor, known as Ogeechee limes, is sometimes made from the fruit in Georgia and South Carolina. The flowers abound in nectar, and are much visited by bees.

Distribution. Deep often inundated river swamps or their borders and ponds; southern South Carolina in the neighborhood of the coast, widely and generally distributed in the Altamaha region of eastern Georgia (*R. M. Harper*); in northern and in western Florida to the mouth of the Choctawhatchee River (*R. H. Harper*), and in the valley of the lower Apalachicola River; rare and local.

4. Nyssa aquatica Marsh. Cotton Gum. Tupelo Gum.

Leaves oblong-ovate, acute or acuminate and often long-pointed at apex, cuneate, rounded, or subcordate at base, entire or remotely and irregularly angulate-toothed, the teeth often tipped with a long slender mucro, when they unfold light red and coated below and on the petioles with pale tomentum and pubescent above, especially on the broad thick midrib, and at maturity thick and firm, dark green and lustrous on the upper surface, pale and more or less downy-pubescent on the lower surface, 5′–7′ long and 2′–4′ wide, with 10–12 pairs of primary veins forked near the margins and connected by conspicuous cross veins; petioles stout, grooved, hairy, enlarged at base, $1\frac{1}{2}'$–$2\frac{1}{2}'$ in length. **Flowers** appearing in March and April on a long slender hairy peduncle from the axil of an inner scale of the terminal bud; staminate in dense capitate clusters, their peduncle furnished near the middle and occasionally at apex with long linear ciliate bractlets; calyx-tube cup-shaped, obscurely 5-toothed, one third as long as the oblong erect petals rounded at apex and much shorter than the stamens; pistillate solitary, surrounded by 2–4 strap-shaped scarious ciliate bractlets often $\frac{1}{2}'$ long and more or less united below into an involucral cup; calyx-tube oblong and much longer than the ovate minute spreading petals; stamens included, with small mostly fertile anthers; style stout, tapering, reflexed above the middle, and revolute into a close coil. **Fruit** ripening early in the autumn, on slender drooping stalks 3′–4′ in

length, oblong or slightly obovoid, crowned with the pointed remnants of the style, dark purple, marked by conspicuous scattered pale dots, and 1′ long, with thick tough skin and thin acid flesh; **stone** obovoid, rounded at the narrow apex, pointed at base, flattened, light

Fig. 703

brown or nearly white, and about 10-ridged, the ridges acute and wing-like, with thin separable margins, and sometimes united by short intermediate ridges.

A tree, 80°–100° high, with a trunk 3°–4° in diameter above the greatly enlarged tapering base, comparatively small spreading branches forming a narrow oblong or pyramidal head, stout pithy branchlets dark red and coated with pale tomentum when they first appear, soon becoming glabrous or nearly so, and in their first winter light or bright red-brown and marked by small scattered pale lenticels and by the conspicuous elevated nearly orbicular leaf-scars displaying the ends of 3 large fibro-vascular bundles, and thick corky roots. **Winter-buds**; terminal nearly globose, with broad ovate light chestnut-brown scales keeled on the back and rounded and apiculate at apex, those of the inner ranks accrescent and at maturity oblong-ovate or oblong-obovate, rounded at apex, 1′ or more long, and bright yellow; axillary minute, obtuse, nearly imbedded in the bark. **Bark** of the trunk about $\frac{1}{4}$′ thick, dark brown, longitudinally furrowed, and roughened on the surface by small scales. **Wood** light, soft, not strong, close-grained, difficult to split, light brown or often nearly white, with thick sapwood sometimes composed of more than 100 layers of annual growth; used in the manufacture of wooden-ware, broom-handles, and wooden shoes, and largely for fruit and vegetable boxes. The wood of the roots is sometimes employed instead of cork for the floats of nets.

Distribution. Deep swamps inundated during a part of every year; coast region of the Atlantic states from southeastern Virginia to northern Florida, through the Gulf states to the valley of the Nueces River, Texas, and through Arkansas and southeastern Missouri to western Kentucky and Tennessee, and to the valley of the lower Wabash River, Illinois; of its greatest size in the Cypress-swamps of western Louisiana and eastern Texas.

LII. CORNACEÆ.

Trees or shrubs, with terete branchlets, scaly buds, and alternate or opposite deciduous leaves, without stipules. Flowers perfect or polygamo-diœcious; calyx 4 or 5-toothed, petals 4 or 5; stamens inserted on the margin of the epigynous disk; anthers oblong; introrse, 2-celled, the cells opening longitudinally; ovary 1 or 2-celled; ovule solitary, suspended from the interior angle of the apex of the cell, anatropous; micropyle superior. Fruit drupaceous, 1 or 2-seeded. Seed oblong-ovoid; seed-coat membranaceous;

embryo in copious fleshy albumen; cotyledons foliaceous; radicle terete, turned toward the hilum.

The widely distributed Cornel family with ten genera, more numerous in temperate than in tropical regions, has arborescent representatives of the genus Cornus in North America.

1. CORNUS L. Dogwood.

Trees and shrubs, with astringent bark, opposite or rarely alternate deciduous leaves conduplicate or involute in the bud. Flowers small, perfect, white, greenish white or yellow; calyx-tube minutely 4-toothed, the teeth valvate in the bud; disk pulvinate, depressed in the centre, or obsolete; petals 4, valvate in the bud, oblong-ovate, inserted on the margin of the disk; stamens 4, alternate with the petals; filaments slender, exserted; ovary 2-celled; style exserted, simple, columnar, crowned with a single capitate or truncate stigma; raphe dorsal. Fruit ovoid or oblong; flesh thin and succulent; nut bony or crustaceous, 2-celled, 2 or sometimes 1-seeded. Seed compressed; embryo straight or slightly incurved.

Cornus with nearly fifty species is widely distributed through the three continents of the northern hemisphere, and south of the equator is represented in Peru by a single species. Of the sixteen or seventeen species of the United States four are arborescent. Cornus is rich in tannic acid, and the bark and occasionally the leaves and unripe fruit are used as tonics, astringents, and febrifuges. Of exotic species, *Cornus mas*, L., is often planted in the eastern states as an ornamental tree, and its edible fruit is used in Europe in preserves and cordials. The wood of Cornus is hard, close-grained, and durable, and is used in turnery and for charcoal.

The generic name, from *cornu*, relates to the hardness of the wood produced by plants of this genus.

CONSPECTUS OF THE ARBORESCENT SPECIES OF THE UNITED STATES.

Flowers greenish, in a dense cymose head surrounded by a conspicuous corolla-like involucre of 4–6 white or rarely red scales, from terminal buds formed the previous summer; fruit ovoid, bright red, rarely yellow.

Heads of flower-buds inclosed by the involucre during the winter; involucral scales 4, obcordate or notched at apex; leaves ovate to elliptic. 1. **C. florida** (A, C).

Heads of flower-buds inclosed only at base by the involucre during the winter; involucral scales 4–6, oblong to obovate, usually acute at apex; leaves ovate or rarely obovate. 2. **C. Nuttallii** (B, G).

Flowers cream color, in a flat cymose head, without involucral scales, terminal on shoots of the year; fruit subglobose, white or dark blue.

Leaves opposite, scabrous above; fruit white. 3. **C. asperifolia** (A, C).

Leaves mostly alternate and clustered at the end of the branches, smooth above; fruit dark blue or rarely yellow. 4. **C. alternifolia** (A, C).

1. Cornus florida L. Flowering Dogwood.

Leaves ovate to elliptic or rarely slightly obovate, acute and often contracted into a slender point at apex, gradually narrowed at base, remotely and obscurely crenulate-toothed on the somewhat thickened margins, and mostly clustered at the end of the branches, when they unfold pale and pubescent below and puberulous above, and at maturity thick and firm, bright green and covered with minute appressed hairs on the upper surface, pale or sometimes almost white and more or less pubescent on the lower surface, 3′–6′ long and $1\frac{1}{2}$′–2′ wide, with a prominent light-colored midrib deeply impressed above, and 5 or 6 pairs of primary veins connected by obscure reticulate veinlets; in the autumn turning bright scarlet on the upper surface, remaining pale on the lower surface; petioles grooved, $\frac{1}{2}$′–$\frac{3}{4}$′ in length. **Flowers:** head of flower-buds appearing during the summer between the upper pair of lateral leaf-buds, inclosed by 4 involucral scales remaining light brown and more or less covered with pale hairs during the winter, and borne on a stout club-shaped puberulous peduncle $\frac{1}{4}$′ long or less during the winter and becoming 1′–$1\frac{1}{2}$′ in length; in-

volucral scales beginning to unfold, enlarge and grow white in early spring and when the flowers open in March at the south to May at the north, when the leaves are nearly fully grown, forming a flat corolla-like cup 3′–4′ in diameter, becoming at maturity obovoid, 1′–

Fig. 704

1½′ wide, gradually narrowed below the middle and notched at the rounded apex, reticulate-veined, pure white, pink, or rarely bright red, deciduous after the fading of the flowers; flowers in dense many-flowered cymose heads, in the axils of broad-ovate nearly triangular minutely apiculate glabrous light green deciduous bracts, ⅛′ in diameter; calyx terete, slightly urceolate, puberulous, obtusely 4-lobed, light green; corolla-lobes strap-shaped, rounded or acute at apex, slightly thickened on the margins, puberulous on the outer surface, reflexed after anthesis, green tipped with yellow; disk large and orange-colored; style crowned with a truncate stigma. **Fruit** ripening in October, ovoid, crowned with the remnants of the narrow persistent calyx and with the style, bright scarlet or rarely yellow (f. *xanthocarpa* Rehd.), lustrous, ½′ long and ¼′ broad, with thin mealy flesh, and a smooth thick-walled slightly grooved stone acute at the ends, and 1 or 2-seeded; **seeds** oblong, pale brown.

A bushy tree, rarely 40° high, with a short trunk 12′–18′ in diameter, slender spreading or upright branches, and divergent branchlets turning upward near the end, pale green or green tinged with red when they first appear, glabrous or slightly puberulous, bright red or yellow-green during their first winter and nearly surrounded by the narrow ring-like leaf-scars, later becoming light brown or gray tinged with red; frequently toward the northern limits of its range a much-branched shrub. **Winter-buds** formed in midsummer; the terminal covered by 2 opposite acute pointed scales rounded on the back and joined below for half their length, and accompanied by 2 pairs of lateral buds, each covered by a single scale, those of the lower pair shedding their scales in the autumn and remaining undeveloped. **Bark** of the trunk ⅛′–¼′ thick, with a dark red-brown surface divided into quadrangular or many-sided plate-like scales. **Wood** heavy, hard, strong, close-grained, brown sometimes changing to shades of green and red, with lighter colored sapwood of 30–40 layers of annual growth; largely used in turnery, for the bearings of machinery, the hubs of small wheels, barrel-hoops, the handles of tools, and occasionally for engravers' blocks.

Distribution. Usually under the shade of taller trees in rich well-drained soil; southern Maine to southern Ontario, southern Michigan, southeastern Kansas and eastern Oklahoma, and southward to central Florida and the valley of the Brazos River, Texas; on the mountains of northern Mexico; comparatively rare at the north; one of the commonest and most generally distributed inhabitants of the deciduous-leaved forests of the middle and southern states, ranging from the coast nearly to the summits of the high Alleghany

Mountains. Trees with rose-colored or with pink involucral scales occasionally occur (var. *rubra* André). A variety with pendulous branches is known in gardens (var. *pendula* Dipp.); the var. *xanthocarpa* near Oyster Bay, Nassau County, Long Island, New York, and at Saluda, Polk County, North Carolina.

Often planted as an ornament of parks and gardens in the eastern states.

2. Cornus Nuttallii Aud. Dogwood.

Leaves ovate or slightly obovate, acute and often contracted into a short point at the apex, cuneate at base, faintly crenulate-serrate, and generally clustered toward the end of the branches, when they unfold coated below with pale tomentum and puberulous above, and at maturity thin, bright green and slightly puberulous, with short appressed hairs on the upper surface, and woolly pubescent on the lower surface, 4′–5′ long and 1½′–3′ wide, with a prominent midrib impressed above, and about 5 pairs of slender primary veins connected by remote reticulate veinlets; in the autumn turning bright orange and scarlet before falling; petioles stout, grooved, pubescent, ½′–⅔′ in length, with a large clasping base. **Flowers**: head of flower-buds appearing during the summer between the upper pair of lateral leaf-buds, surrounded at base but not inclosed by the involucral scales during the winter, hemispheric, ½′ in diameter, usually nodding on a stout hairy peduncle ¾′–1′ long; involucral scales becoming when the flowers open 1½′–3′ long and 1½′–2′ wide, white or white tinged with pink, oblong to obovate or nearly orbicular, and acute, acuminate,

Fig. 705

or obtuse, entire and thickened at apex, puberulous on the outer surface, gradually narrowed below the middle and conspicuously 8-ribbed, the spreading ribs united by reticulate veinlets; flowers in dense cymose heads from the axils of minute acuminate scarious deciduous bracts; calyx terete, slightly urceolate, puberulous on the outer surface, yellow-green, or light purple, with dark red-purple lobes; petals strap-shaped, rounded at apex, spreading, somewhat puberulous on the outer surface, with thickened slightly inflexed margins, yellow-green; style crowned with a truncate stigma. **Fruit** ripening in October, in dense spherical heads of 30–40 drupes surrounded at base by a ring of abortive pendulous ovaries, ½′ long, ovoid, much flattened, crowned with the broad persistent calyx, bright red or orange-colored, with thin mealy flesh, and a thick-walled 1 or 2-seeded stone obtuse at the ends and scarcely grooved; **seeds** oblong, compressed, with a very thin pale papery coat.

A tree, 40°–60°, or exceptionally 100° high, with a trunk 1°–2° in diameter, small spreading branches forming an oblong conic or ultimately round-topped head, and slender light green branchlets coated while young with pale hairs, becoming glabrous or puberulous, dark

reddish purple or sometimes green during their first winter and conspicuously marked by the elevated lunate leaf-scars, ultimately becoming light brown or brown tinged with red. **Winter-buds** formed in July; the terminal acute, $\frac{1}{3}'$ long, covered by 2 narrow-ovate acute long-pointed puberulous light green opposite scales, accompanied by 2 pairs of lateral buds, each covered by a single scale, those of the lower pair shedding their scales in the autumn and remaining undeveloped, those of the upper pair clothed with pale hairs, especially toward the apex, their scales thickening, turning dark purple, lengthening in the spring with the inclosed shoot, finally becoming scarious and developing into small leaves, and in falling marking the base of the branchlets with ring-like scars. **Bark** of the trunk about $\frac{1}{4}'$ thick, brown tinged with red, and divided on the surface into small thin appressed scales. **Wood** heavy, exceedingly hard, strong, close-grained, light brown tinged with red, with lighter colored sapwood of 30–40 layers of annual growth; used in cabinet-making, for mauls and the handles of tools.

Distribution. Usually in moist well-drained soil under the shade of coniferous forests; valley of the lower Fraser River and Vancouver Island, British Columbia, southward through western Washington and Oregon, on the coast ranges of California to the San Bernardino Mountains, and on the western slopes of the Sierra Nevada; southward up to altitudes of 4000°–5000°, of its largest size near the shores of Puget Sound and in the Redwood-forests of northern California.

3. Cornus asperifolia Michx. Dogwood.

Leaves ovate or oblong, gradually or abruptly contracted at apex into a long slender point, gradually narrowed or rounded and cuneate at base, and slightly thickened on the

Fig. 706

undulate margins, coated with lustrous silvery tomentum when they unfold, and nearly fully grown when the flowers open from the middle of May in Texas to the middle of July at the north, and then dark green and roughened above by short rigid white hairs, and pale, often glaucous or rough-pubescent below, and at maturity thin, scabrous on the upper surface, pubescent or puberulous on the lower surface, 3′–4′ long and $1\frac{1}{2}'$–2′ wide, with a thin midrib, and 4–6 pairs of slender primary veins parallel with their sides; petioles stout, grooved, pubescent, usually about $\frac{1}{2}'$ in length. **Flowers** cream color, on slender pedicels, in loose broad or narrow often panicled pubescent cymes, on peduncles frequently 1′ in length; calyx oblong, cup-shaped, obscurely toothed, covered with fine silky white hairs; corolla-lobes narrow-oblong, acute, about $\frac{1}{8}'$ long, and reflexed after the flowers open; style thickened at apex into a prominent stigma. **Fruit** ripening from the end of August

until the end of October, in loose spreading red-stemmed clusters, subglobose, white, tipped with the remnants of the style, about $\frac{1}{4}'$ in diameter, with thin dry, bitter flesh, and a full and rounded stone broader than high, somewhat oblique, slightly grooved on the edge, and 1 or 2-seeded; **seeds** nearly $\frac{1}{4}'$ long, with a pale brown coat.

A tree, sometimes nearly 50° high, with a short trunk 8′–10′ in diameter, thin erect wand-like branches forming a narrow irregular rather open head, and slender branchlets marked by numerous small pale lenticels, light green and puberulous when they first appear, pale red, lustrous, and puberulous during their first winter, light reddish brown in their second year, and ultimately light gray-brown or gray; usually shrubby. **Winter-buds** acute, compressed, pubescent, sessile, or stalked, about $\frac{1}{8}'$ long, with 2 pairs of opposite scales, the terminal bud nearly twice as large as the compressed lateral buds. **Bark** of the trunk about $\frac{1}{8}'$ thick, and divided by shallow fissures into narrow interrupted ridges broken into small closely appressed dark red-brown scales **Wood** close-grained, hard, pale brown, with thick cream-colored sapwood.

Distribution. Southwestern Ontario (Point Pelee and Pelee Island), southward through Ohio, Kentucky, Tennessee and Mississippi to western Florida (Gadsden and Levy Counties) and westward to southeastern South Dakota, southeastern Nebraska, central Kansas, northwestern Oklahoma (near Alva, Woods County) and western Texas (Kerr, Menard and Brown Counties); probably only arborescent on the rich bottomlands of southern Arkansas and eastern Texas.

4. Cornus alternifolia L. Dogwood.

Leaves mostly alternate, clustered at the end of the branches, rarely opposite, oval or ovate, gradually contracted at apex into a long slender point, cuneate or occasionally some-

Fig. 707

what rounded at base, obscurely crenulate-toothed on the slightly thickened and incurved margins, coated when they unfold on the lower surface with dense silvery white tomentum, and faintly tinged with red and pilose above, and at maturity thin, bright yellow-green, glabrous or sparsely pubescent on the upper surface, pale or sometimes nearly white and covered with appressed hairs on the lower surface, 3′–5′ long and $2\frac{1}{2}'$–$3\frac{1}{2}'$ wide, with a broad orange-colored midrib slightly impressed above, and about 6 pairs of primary veins parallel with their sides; in the autumn turning yellow or yellow and scarlet; petioles slender, pubescent, grooved, $1\frac{1}{2}'$–$2'$ in length, with an enlarged clasping base. **Flowers** cream color, opening from the beginning of May to the end of June on slender jointed pedicels $\frac{1}{8}'$–$\frac{1}{4}'$ long, in terminal flat puberulous many-flowered cymes $1\frac{1}{2}'$–$2\frac{1}{2}'$ wide, mostly on lateral branchlets; calyx cup-shaped, obscurely toothed; corolla-lobes narrow, oblong, rounded at apex, $\frac{1}{8}'$ long, reflexed after anthesis; style enlarged into a prominent stigma. **Fruit** in loose spreading

red-stemmed clusters, ripening in October, subglobose, dark blue-black, or rarely yellow (f. *ochrocarpa* Rehd.). ½′ in diameter, tipped with the remnants of the style rising from the bottom of a small depression, with thin and bitter flesh; and an obovoid nutlet, pointed at base, gradually longitudinally many-grooved, thick-walled, and 1 or 2-seeded; seeds lunate, ¼′ long, with a thin membranaceous pale coat.

A flat-topped tree, rarely 25°–30° high, with a short trunk 6′–8′ in diameter, long slender alternate diverging horizontal branches, and numerous short upright slender branchlets pale orange-green or reddish brown when they first appear, mostly light green or sometimes brown tinged with green during their first winter, later turning darker green and marked by pale lunate leaf-scars and small scattered pale lenticels; often a shrub, with numerous stems. **Bark** of the trunk about ⅛′ thick, dark reddish brown, and smooth or divided by shallow longitudinal fissures into narrow ridges irregularly broken transversely. **Wood** heavy, hard, close-grained, brown tinged with red, with thick lighter colored sapwood of 20–30 layers of annual growth.

Distribution. Rich woodlands, the margins of the forest, and the borders of streams and swamps, in moist well-drained soil, New Brunswick and Nova Scotia, westward along the valley of the St. Lawrence River to the northern shores of Lake Superior and to Minnesota, and southward through the northern states to Iowa and southern Missouri (Monteer, Shannon County) and along the Appalachian Mountains to North Carolina, up to altitudes of 3500°–4000°; in Alabama to Covington County, southwestern Georgia, and western Florida (River Junction, Gadsden County, *T. G. Harbison*).

Occasionally cultivated as an ornamental plant in the eastern states.

Section 2. Gamopetalæ. Corolla of united petals (*divided in Elliottia in Ericaceæ 0 in some species of Fraxinus in Oleaceæ*).

A. Ovary superior (*inferior in Vaccinium in Ericaceæ, partly inferior in Symplocaceæ, partly superior in Styraceæ*)

LIII. ERICACEÆ.

Trees or shrubs, with scaly buds, and alternate simple leaves, without stipules. Flowers perfect, regular; calyx 4–5-lobed; corolla hypogynous, 5-lobed (*of 4 petals in Elliottia*), the lobes imbricated in the bud; stamens hypogynous, mostly free from the corolla, as many, or twice as many as its lobes; anthers introrse, 2-celled, opening by terminal pores, often appendaged; ovary 4–10-celled (*inferior in Vaccinium*); styles terminal, simple, stigma terminal; ovules numerous, anatropous or amphitropous; raphe ventral; micropyle superior. Fruit capsular, drupaceous, or baccate. Seeds with fleshy or horny albumen; embryo small; cotyledons small and short.

The Heath family with seventy-one genera is widely distributed over the temperate and tropical parts of the earth's surface. Of the twenty-one genera found in the United States seven have arborescent representatives.

CONSPECTUS OF THE ARBORESCENT GENERA OF THE UNITED STATES.

Ovary superior.

Corolla of 4 petals; flowers in erect racemose panicles; leaves deciduous. 1. **Elliottia.**

Corolla gamopetalous, 5-lobed.

Fruit capsular.

Capsule septicidal, the valves in opening separating from the persistent placentiferous axis; calyx-lobes imbricated in the bud; leaves persistent (*sometimes deciduous*).

Flowers in terminal clusters; corolla 5-lobed; inflorescence-buds conic, covered with closely imbricated scales; leaves revolute on the margins. 2. **Rhododendron.**

Flowers in axillary clusters; corolla saucer-shaped, with a short narrow tube and 10 pouches below the short limb, the anthers in the pouches in the bud: inflorescence-buds elongated, covered with loosely imbricated scales; leaves flat. 3. **Kalmia.**

Capsule loculicidal, the valves in opening bearing the partitions and separating from the persistent placentiferous axis; calyx-lobes valvate in the bud.

Capsule ovoid-pyramidal; flowers in terminal panicles of secund racemes; anther-cells opening longitudinally from the apex to the middle; leaves deciduous. **4. Oxydendrum.**

Capsule oblong; flowers in axillary fascicles; anthers opening below the apex by 2 oblong pores; leaves persistent. **5. Xolisma.**

Fruit drupaceous; flowers in terminal panicles; anthers bearing a pair of reflexed awns on the back, each cell opening at apex anteriorally by a terminal pore; leaves persistent. **6. Arbutus.**

Ovary inferior; fruit baccate; flowers axillary, racemose or solitary; anther-cells terminating in tubular appendages and opening by terminal pores. **7. Vaccinium.**

1. ELLIOTTIA Ell.

A glabrous tree or shrub, with slender terete branchlets, scaly buds, and fibrous roots. Leaves petiolate, oblong or oblong-obovate, acute at the ends or occasionally rounded at apex, entire, thin, dark green and glabrous above, pale and villose below, particularly on the thin yellow midrib and obscure forked veins; deciduous; petioles slender and flattened, with an abruptly enlarged base nearly covering the small axillary buds. Flowers perfect, on slender elongated pedicels, in erect terminal elongated racemose panicles, with minute acute scarious caducous bracts and bractlets; calyx short, tubular, puberulous, dark red-brown, 4-toothed, the broad apiculate teeth erose on the margins and imbricated in the bud; petals 4, imbricated in the bud, spatulate-linear, sessile; stamens 8, hypogynous, shorter than the petals, filaments broad, flattened; anthers oblong-ovoid, the cells callous-mucronate, free at the apex of the spreading lobes, opening from above downward; disk much thickened, fleshy; ovary sessile, subglobose, 4-lobed, 4-celled, concave at apex; style elongated, slender, gradually enlarged and club-shaped above and incurved at apex; stigma 3–5-lobed, smaller than the thickened end of the style; ovules numerous in each cell, attached on the inner angle of a tumid placenta, ascending, anatropous. Fruit unknown.

Elliottia with a single species is confined to the southern United States.

The genus is named in honor of Stephen Elliott (1771–1830), the distinguished botanist of South Carolina.

1. Elliottia racemosa Ell.

Leaves 3′–4′ long, 1′–1½′ wide; petioles ⅓′–½′ in length. **Flowers** about ½′ long, opening from the middle to the end of June, in clusters 7′–10′ in length.

A tree, 15°–20° high, with a trunk 4′–5′ in diameter, short ascending branches forming

Fig. 703

a pyramidal head, and erect branchlets light red-brown and pilose when they first appear, bright orange-brown, lustrous, and nearly glabrous during their first winter, and roughened by slightly raised oblong-obovate leaf-scars with conspicuous central fibro-vascular bundle-scars, becoming light brown slightly tinged with red during their second season and dark gray-brown the following year; or more frequently shrubby. **Winter-buds:** terminal broad-ovoid, acute, about $\frac{1}{8}'$ long, with much thickened bright chestnut-brown shining scales conspicuously white-pubescent near the margins toward the apex; lateral buds smaller, ovoid, compressed, rounded or short-pointed at apex. **Bark** thin, smooth, pale gray.

Distribution. Sandy woods in a few isolated stations in the valley of the Savannah River, near Augusta, Richmond County, and in Burke and Bullock Counties, Georgia.

2. RHODODENDRON L.

Trees or shrubs, with scaly bark, terete branchlets, terminal buds formed in summer, and fibrous roots. Leaves usually clustered at the end of the branches, revolute and entire on the margin, persistent or deciduous. Flowers in terminal umbellate corymbs from buds with numerous caducous scales; calyx 5-parted or toothed, persistent under the fruit; corolla 5–10-lobed, deciduous; stamens 5 or 10, rarely more, more or less unequal, ultimately spreading; filaments subulate-filiform, pilose at the base; disk thick and fleshy, crenately lobed; ovary 5–10-celled; style slender, crowned with a capitate stigma and persistent on the fruit; ovules numerous in each cell, attached in many series to an axile 2-lipped placenta projected from the inner angle of the cell, anatropous. Fruit a woody many-seeded capsule. Seed scobiform; seed-coat loose, reticulate, produced at the ends beyond the nucleus into a short often laciniate appendage; embryo minute, cylindric, axile in fleshy albumen; cotyledons oblong, shorter than the radicle turned toward the hilum.

Rhododendron with some four or five hundred species occurs in eastern Thibet, on the Himalayas, in southwestern China, the Malay peninsula and Archipelago, New Guinea, northern China and Corea, Japan, the mountains of central Europe, on the Caucasus, and in eastern and western North America, the largest number of species being found in southwestern China and on the Himalayas. Of the twenty-three or twenty-four North American species one only is arborescent.

Rhododendron possesses astringent narcotic properties. It produces hard close-grained compact wood sometimes used in turnery and for fuel. Many of the species are cultivated in gardens for the beauty of their large and conspicuous flowers.

The generic name is from *ῥόδον* and *δένδρον*, the Rose-tree.

1. Rhododendron maximum L. Great Laurel. Rose Bay.

Leaves revolute in the bud, ovate-lanceolate or obovate-lanceolate, acute or short-pointed at apex, and narrowed, cuneate or rounded at base, when they unfold covered with a thick pale or ferrugineous tomentum of gland-tipped hairs, and at maturity glabrous, thick and coriaceous, dark green and lustrous on the upper surface, usually pale or whitish on the lower surface, $4'$–$12'$ long and $1\frac{1}{2}'$–$2\frac{1}{2}'$ wide, with a broad pale midrib and obscure reticulate veinlets; persistent for two or three years; petioles stout, ridged above, rounded below, $1'$–$1\frac{1}{2}'$ in length. **Flowers:** inflorescence-buds surrounded at first by several loose narrow leaf-like scales, and when fully grown in September cone-shaped, $1\frac{1}{2}'$ long and $\frac{1}{2}'$ broad, with many imbricated ovate scales rounded and contracted at apex into a long slender point, opening late in June after the shoots of the year from buds in the axils of upper leaves have reached their full length; flowers on slender pink pedicels covered with glandular white hairs and furnished at base with two linear scarious bractlets, from the axils of the scales of the inner ranks of the inflorescence-bud, in 16–24-flowered umbellate clusters $4'$–$5'$ in diameter, with accrescent scarious resinous puberulous bracts, those of the outer ranks becoming $1'$ long and $\frac{1}{3}'$ wide, and shorter than the lanceolate bracts of the inner ranks contracted into a long slender point; calyx light green and puberulous, with rounded remote lobes; corolla prominently 5-angled or ridged in the bud, cam-

panulate, gibbous on the posterior side, puberulous in the throat, light rose color, purplish, or white, 1′ long, cleft to the middle into 5 oval rounded lobes, with conspicuous central veins, the upper lobe marked on the inner face by a cluster of yellow-green spots, and

Fig. 709

furnished on the outer surface at the bottom of each sinus with a conspicuous dark red gland; stamens 8–12, white, inserted on the bright green disk; filaments enlarged and flattened at base, slightly bent inward above the middle, and bearded with stiff white hairs, the 4 or 5 short ones at the back of the flower for more than half their length and the others only near the base; ovary ovoid, green, coated with short glandular pale hairs, crowned with a long slender glabrous white declining style club-shaped and inflexed at apex, and terminating in a 5-rayed scarlet stigma. **Fruit** dark red-brown, ovoid, $\frac{1}{2}'$ long, glandular-hispid, ripening and shedding its seeds in the autumn, the clusters of open capsules remaining on the branches until the following summer; **seeds** oblong, flattened, the coat prolonged at the ends into scarious fringed appendages.

A bushy tree, 30°–40° high, with a short crooked often prostrate trunk occasionally 10′–12′ in diameter, stout contorted branches forming a round head, and branchlets green tinged with red and covered with dark red or slightly ferrugineous glandular-hispid hairs when they first appear, dark green and glabrous in their first winter, gradually turning bright red-brown in their second year, and ultimately gray tinged with red, the thin bark separating on branches four or five years old into persistent scales; more often a broad shrub, with many divergent twisted stems 10°–12° high. **Winter-buds**: leaf-buds conic, dark green, axillary, or terminal on barren shoots, with many closely imbricated scales, those of the inner ranks accrescent, increasing in length from the outer to the inner, and at maturity $1\frac{1}{2}'$ long, $\frac{1}{4}'$ wide, gradually narrowed at base, and terminating at apex in a long slender point, light green, glabrous, closely held against the shoot by a resinous exudation from the glandular hairs, and in falling marking the branchlet with numerous conspicuous narrow remote scars persistent for three or four years. **Bark** of the trunk about $\frac{1}{16}'$ thick, light red-brown, broken on the surface into small thin appressed scales. **Wood** heavy, hard, strong, rather brittle, close-grained, light clear brown, with thin lighter colored sapwood; occasionally made into the handles of tools and used as a substitute for boxwood in engraving. A decoction of the leaves is occasionally employed in domestic practice in the treatment of rheumatism.

Distribution. Nova Scotia, Mt. Chocorua, New Hampshire, and southward in New England and eastern New York and along the Appalachian Mountains to northern Georgia and westward to the northern shores of Lake Erie and to southeastern Ohio (Hocking and Fairfield Counties); rare at the north and an inhabitant of deep cold swamps in a few

isolated stations; more abundant on the mountains of western Pennsylvania, becoming exceedingly common farther south and occupying the steep banks of streams up to altitudes of 3000°; of its largest size on the high mountains of eastern Tennessee and the Carolinas, and here often forming thickets hundreds of acres in extent.

Often cultivated as an ornament of parks and gardens in the United States, and in Europe, and one of the parents of a number of distinct and beautiful hybrids.

3. KALMIA L.

Trees or shrubs, with scaly bark, terete branchlets without a terminal bud, minute axillary leaf-buds, elongated axillary inflorescence-buds covered by imbricated scales, and fibrous roots. Leaves ovate-oblong or linear, short-petiolate, with flat entire margins, coriaceous, persistent or deciduous in one species. Flowers on slender pedicels bibracteolate at the base, from the axils of foliaceous coriaceous ovate or acute persistent bracts, in axillary umbels; calyx 5, rarely 6-parted, the divisions imbricated in the bud, persistent under the fruit; corolla 5, rarely 6-lobed, rose-colored, purple, or white, saucer-shaped, with a short tube and 10 pouches just below the 5 or 6-parted limb, the lobes ovate, acute, before anthesis prominently 10 or 12-ribbed from the pouches to the acute apex of the bud, the salient keel of the ribs running to the point of the lobes and to the sinuses; stamens 10, shorter than the corolla; filaments filiform; anthers oblong, each cell opening by a short apical oblong longitudinal pore, at first free in the bud, the filaments then erect, later received in the pouches of the corolla, the filaments becoming bent back by its enlargement and expansion, straightening elastically and incurving on the release of the anthers, and in straightening discharging the pollen-grains; disk prominently 10-lobed; ovary subglobose, 5-celled; style filiform, exserted, crowned with a capitate stigma; ovules numerous in each cell, inserted on a 2-lipped placenta, pendulous or spreading from near the top of the thin columella, few-ranked, anatropous. Fruit a woody many-seeded globose slightly 5-lobed 5-celled capsule, tardily septicidally 5-valved, the valves crustaceous, ultimately opening down the middle by a narrow slit and separating from the persistent placenta-bearing axis. Seeds oblong or subglobose, minute; seed-coat crustaceous or membranaceous; embryo in fleshy albumen, terete, near the hilum; radicle erect, rather shorter than the oblong cotyledons.

Kalmia with six species is North American and Cuban, one species occasionally becoming under favorable conditions a small tree.

The generic name is in honor of the Swedish traveler and botanist, Peter Kalm (1715–1779).

1. Kalmia latifolia L. Laurel. Mountain Laurel.

Leaves sometimes in pairs or in 3's, conduplicate in the bud, each leaf in the bud inclosed by the one immediately below it, oblong or elliptic-lanceolate, acute or rounded and tipped at apex with a callous point, and gradually narrowed at base, rarely oval to oblong-obovate and rounded at ends (f. *obtusata* Rehd.), when they unfold slightly tinged with pink and covered with glandular white hairs, and at maturity thick and rigid, dark rather dull green above, light yellow-green below, 3′–4′ long and 1′–1½′ wide, with a broad yellow midrib and obscure immersed veins; beginning to fall during their second summer; petioles stout, terete or slightly flattened, about ⅔′ in length. **Flowers** opening from early in April in southern Mississippi to the 20th of June at the north; inflorescence-buds appearing in the autumn from the axils of upper leaves, beginning to lengthen with the first warm days of spring and usually developing 2 or several lateral branches, the whole forming a compound many-flowered corymb of numerous crowded fascicles more or less covered with dark scurfy scales, 4′–5′ in diameter, and overtopped at the flowering time by the leafy branches of the year; flowers nearly 1′ in diameter, on long slender red or green pedicels covered with glandular hairs, and furnished at base with 2 minute acute bractlets, developed from the axils of acute persistent bracts sometimes ½′ long; calyx divided nearly to the base into narrow acute thin green lobes; corolla white (f. *alba* Rehd.), rose-color, or deep

pink (f. *rubra* Rehd.) viscid-pubescent, marked on the inner surface with a waving dark rose-colored line and with delicate purple penciling above the sacs, rarely with a broad purple or chocolate-colored band (f. *fuscata* Rehd.). **Fruit** ripening in September, crowned with the persistent style, $\frac{3}{16}'$ in diameter, and covered with viscid hairs, remaining on the branches until the following year; **seeds** oblong, light brown, scattered by the opening of the valves.

A tree, rarely 30°–40° high, with a short crooked and contorted trunk sometimes 18′–20′ in diameter, stout forked divergent branches forming a round-topped compact head, and slender branchlets light green tinged with red and covered with soft white glandular-viscid hairs when they first appear, soon becoming glabrous, and in their first winter green tinged with red and very lustrous, turning bright red-brown during their second year and paler the following season, the bark then separating into large thin papery scales exposing the cinnamon-red inner bark, and marked with large deeply impressed leaf-scars showing near the centre a crowded cluster of fibro-vascular bundle-scars; more often a dense broad shrub 6°–10° high, with numerous crooked stems. **Winter-buds** formed before midsummer in the axils of the leaves just below those producing the inflorescence-buds, their inner scales

Fig. 710

accrescent, and at maturity often 1′ long and $\frac{1}{2}'$ wide, ovate, acute, light green, covered with glandular white hairs, and in falling marking the base of the shoots with conspicuous broad scars. **Bark** of the trunk hardly more than $\frac{1}{16}'$ thick, dark brown tinged with red, and divided by longitudinal furrows into narrow ridges separating into long narrow scales. **Wood** heavy, hard, strong, rather brittle, close-grained, brown tinged with red, with slightly lighter colored sapwood; used for the handles of tools, in turnery, and for fuel.

Distribution. New Brunswick to the northern shores of Lake Erie and southward in the Atlantic coast region to Virginia and to southern Ohio, Clark, Perry and Crawford Counties, Indiana and central Tennessee, along the Appalachian Mountains and their foot-hills to Georgia, and from western Florida through Alabama to eastern and southern Mississippi and the valley of the Bogue Lusa River, Washington Parish, Louisiana; often growing in low moist ground near the margins of swamps or on dry slopes under the shade of deciduous-leaved trees, or on rich rocky hillsides; most abundant and often forming dense impenetrable thickets on the southern Appalachian Mountains up to altitudes of 3000°–4000°; usually shrubby, and only arborescent in a few secluded valleys between the Blue Ridge and the Alleghany Mountains of North and South Carolina; abundant and of large size along small streams in Liberty County, middle Florida. The var. *myrtifolia* K. Koch with small lance-oblong leaves, and small compact clusters of small flowers, a compact

dwarf shrub, and an old inhabitant of European gardens, is occasionally wild in Massachusetts; in an abnormal form (f. *polypetala* Rehd.) found in western Massachusetts the corolla is divided into 5 narrow petals.

Often cultivated as an ornament of parks and gardens in the eastern states, and in Europe.

4. OXYDENDRUM DC.

A tree, with thick deeply furrowed bark, slender terete glabrous light red or brown branchlets, without a terminal bud, marked by elevated nearly triangular leaf-scars displaying a lunate row of crowded fibro-vascular bundle-scars, and numerous elevated oblong dark lenticels, acid foliage, and fibrous roots. Winter-buds axillary, minute, partly immersed in the bark, obtuse, covered with opposite broad-ovate dark red scales rounded at apex, those of the inner ranks accrescent. Leaves alternate, revolute in the bud, oblong or lanceolate, acute, gradually contracted at base into a long slender petiole, serrate with minute incurved callous teeth, penniveined, with a conspicuous bright yellow midrib and reticulate veinlets, thin and firm, dark green and lustrous on the upper surface, pale and glaucous on the lower surface, glabrous or at first slightly puberulous, deciduous. Flowers on erect clavate pedicels coated with hoary pubescence and bibracteolate above the middle, with linear acute caducous bractlets, in puberulous panicles of secund racemes appearing in summer and terminal on axillary leading shoots of the year, the lower racemes in the axils of upper leaves; calyx free, divided nearly to the base, the divisions valvate in the bud, ovate-lanceolate, acute, pubescent or puberulous on the outer surface, persistent under the fruit; corolla hypogynous, cylindric to ovate-cylindric, white, puberulous, 5-lobed, the lobes minute, ovate, acute, reflexed; stamens 10, included; filaments subulate, broad, pilose, inserted on the very base of the corolla; anthers linear-oblong, narrower than the filaments, the cells opening from the apex to the middle; disk thin, obscurely 10-lobed; ovary broad-ovoid, pubescent, 5-celled; style columnar, thick, exserted, crowned with a simple stigma; ovules attached to an axile placenta rising from the base of the cell, ascending, amphitropous. Fruit a 5-celled ovoid-pyramidal many-seeded capsule crowned with the remnants of the persistent style, 5-lobed, puberulous, loculicidally 5-valved, the valves woody, separating from the central persistent placentiferous axis, many-seeded. Seeds ascending, elongated; seed-coat membranaceous, loose, reticulated, produced at the ends into long slender points; embryo minute, axile in fleshy albumen, cylindric; radicle terete, next the hilum.

The genus consists of a single species.

The generic name is from ὀξύς and δένδρον, in allusion to the acid foliage.

1. Oxydendrum arboreum DC. Sorrel-tree. Sour Wood.

Leaves when they unfold bronze-green, very lustrous and glabrous with the exception of a slight pubescence on the upper side of the midrib and a few scattered hairs on the under side of the midrib and on the petioles, and at maturity 5′–7′ long and 1½′–2½′ wide; turning bright scarlet in the autumn; petioles ⅔′ in length. **Flowers** opening late in July or early in August, ⅓′ long, in panicles 7′–8′ in length. **Fruit** ⅓′–½′ long, hanging in drooping clusters sometimes a foot in length, ripening in September, the empty capsules often persistent on the branches until late in the autumn; **seeds** about ⅛′ long, pale brown.

A tree, occasionally 50°–60° high, with a tall straight trunk 12′–20′ in diameter, slender spreading branches forming a narrow oblong round-topped head, and glabrous branchlets yellow-green and marked by orange-colored lenticels when they first appear, becoming in their first winter orange-colored to reddish brown. **Winter-buds** about $\frac{1}{16}$′ long, their inner scales at maturity 1′ in length, ⅛′ wide, spatulate, acute at apex, and slightly puberulous on the inner surface and on the margins. **Bark** of the trunk ⅔′–1′ thick, gray tinged with red, and divided by longitudinal furrows into broad rounded ridges covered with small thick appressed scales. **Wood** heavy, hard, very close-grained, brown tinged with red, with lighter colored sapwood of 80–90 layers of annual growth; sometimes used locally for the

handles of tools and the bearings of machinery. The leaves have a pleasant acidulous taste, and are reputed to be tonic, refrigerant, and diuretic, and are occasionally used in domestic practice in the treatment of fevers.

Distribution. Well-drained gravelly soil on ridges rising above the banks of streams; coast of Virginia (Accomac County) to that of North Carolina (near Newbern, Craven

Fig. 711

County), southwestern Pennsylvania to southern Ohio and Indiana (Perry County), and to western Kentucky and Tennessee, along the Appalachian Mountains and their foothills, and southward to western Florida, the shores of Mobile Bay, the coast region of Mississippi, and West Feliciana Parish, Louisiana; up to altitudes of 3500° on the southern mountains: of its largest size on the western slopes of the Big Smoky Mountains, Tennessee.

Often cultivated as an ornamental plant in the eastern states and hardy as far north as eastern Massachusetts, and occasionally in western and central Europe.

5. XOLISMA. Raf.

Lyonia Nutt.

Trees or shrubs, with slender terete branchlets, and fibrous roots. Leaves petiolate, thin or coriaceous. Flowers on slender pedicels from the axils of ovate acute bracts, in axillary and terminal umbellate fascicles or panicled racemes; calyx persistent, 4–5-toothed or parted, the divisions valvate in the bud; corolla globular, 4 or 5-toothed or lobed, the lobes imbricated in the bud; stamens 8–10, included; filaments flat, incurved, usually slightly adnate to the base of the corolla, dilated and bearded at base, geniculate; anthers oblong, the cells opening below the apex by large oblong pores; disk 10-lobed; ovary 5-celled, depressed in the centre; style columnar, stigmatic at apex; ovules attached to a placenta borne near the summit of the axis, anatropous. Fruit ovoid, many-seeded, loculicidally 5-valved, the valves septiferous and separating from the placentiferous axis, 5-ribbed by the thickening of the valves at the dorsal sutures, the ribs more or less separable in dehiscence. Seeds minute, pendulous, narrow-oblong; seed-coat loose, thin, reticulate, produced at the ends beyond the nucleus into short fringe-like wings; embryo axile in fleshy albumen, cylindric, elongated· cotyledons much shorter than the terete radicle turned toward the hilum.

Lyonia with about twenty species is confined to North America, the West Indies, and Mexico. Of the four or five species which occur in the United States one is occasionally a small tree.

The derivation of the name Xolisma is obscure.

1. Xolisma ferruginea Hell.

Lyonia ferruginea Nutt.

Leaves cuneate-obovate, rhombic-obovate or cuneate-oblong, acute or rounded at apex, usually tipped with a cartilaginous mucro, gradually narrowed at base, and entire, with thickened revolute margins, scurfy when they unfold, and at maturity thick and firm, pale green, smooth and shining or sometimes obscurely lepidote above, covered below with ferrugineous or pale scales, 1′–3′ long and $\frac{1}{4}$′–1$\frac{1}{2}$′ wide, with a prominent midrib and primary veins; appearing in early spring and persistent until the summer or autumn of their second year; petioles short, thick, much enlarged at base. **Flowers** $\frac{1}{8}$′ in diameter, chiefly produced on branches of the year or occasionally on those of the previous year, opening from February until April when the leaves are fully grown, on slender recurved pedicels much shorter than the leaves, in crowded axillary short-stemmed or sessile ferrugineous-lepidote fascicles, with minute acute deciduous bracts and bractlets; calyx 5-lobed, with acute lobes, covered on the outer surface with ferrugineous scales, and about one third as long as the white pubescent corolla, with short reflexed acute teeth slightly thickened and ciliate on

Fig. 712

the margins; filaments shortened by a conspicuous geniculate fold in the middle; ovary coated with thick white tomentum; style stout, as long or a little longer than the corolla. **Fruit** on a stout erect stem, oblong, 5-angled, $\frac{1}{4}$′ long; **seed** pale brown.

A tree, occasionally 20°–30° high, with a slender crooked or often prostrate trunk sometimes 10′ in diameter, thin rigid divergent branches forming a tall oblong irregular head, and slender branchlets coated when they first appear with minute ferrugineous scales and covered in their second year with glabrous or pubescent light or dark red-brown bark smooth or exfoliating in small thin scales. **Winter-buds** minute, acute, and covered with ferrugineous scales. **Bark** of the trunk $\frac{1}{8}$′–$\frac{1}{4}$′ thick, divided into long narrow ridges by shallow longitudinal furrows, reddish brown and separating into short thick scales. **Wood** heavy, hard, close-grained although not strong, light brown tinged with red, with thick lighter colored sapwood.

Distribution. Hummocks and sandy woods; coast region of South Carolina and Georgia, northern Florida to the centre of the peninsula, the shores of Tampa Bay, and to the neighborhood of Apalachicola (Franklin County); in the United States arborescent in the rich soil of the woody hummocks rising in the sandy Pine-covered coast plain, and as a low shrub in the dry sandy sterile soil of Pine-barrens; in the West Indies and Mexico.

6. ARBUTUS L.

Trees or shrubs, with astringent bark exfoliating from young stems in large thin scales, smooth terete red branches, and thick hard roots. Leaves petiolate, entire or dentate, obscurely penniveined, persistent. Flowers on clavate pedicels bibracteolate at base from the axils of ovate bracts, in simple terminal compound racemes or panicles, with scarious scaly persistent bracts and bractlets; calyx free from the ovary, 5-parted nearly to the base, the divisions imbricated in the bud, ovate, acute, scarious, persistent; corolla ovoid-urceolate, white, 5-toothed, the teeth obtuse and recurved; stamens 10, shorter than the corolla; filaments subulate, dilated and pilose at base, free, inserted in the bottom of the corolla; anthers short, compressed laterally, dorsally 2-awned, the cells opening at the top internally by a terminal pore; ovary glandular-roughened, glabrous or tomentose, sessile or slightly immersed in the glandular 10-lobed disk, 5 or rarely 4-celled; style columnar, simple, exserted; stigma obscurely 5-lobed; ovules attached to a central placenta developed from the inner angle of each cell, amphitropous. Fruit drupaceous, globose, smooth or glandular-coated, 5-celled, many-seeded; flesh dry and mealy; stone cartilaginous, often incompletely developed. Seeds small, compressed or angled, narrowed and often apiculate at apex; seed-coat coriaceous, dark red-brown, slightly pilose; embryo axile in copious horny albumen, clavate; radicle terete, erect, turned toward the hilum.

Arbutus with ten or twelve species inhabits southern and western North America, Central America, western, southern and eastern Europe, Asia Minor, northern Africa, and the Canary Islands. Three species occur within the territory of the United States. Arbutus produces hard close-grained valuable wood often made into charcoal, used in the manufacture of gunpowder. The fruit possesses narcotic properties, and the bark and leaves are astringent.

Arbutus is the classical name of the species of southern Europe.

CONSPECTUS OF THE SPECIES OF THE UNITED STATES.

Bark of old trunks dark red-brown.
- Ovary glabrous; leaves oval or oblong. — 1. **A. Menziesii** (B, G).
- Ovary pubescent; leaves oval, ovate, or lanceolate. — 2. **A. texana** (C).

Bark of old trunks ashy gray; ovary glabrous, conspicuously porulose; leaves lanceolate or rarely narrow-oblong. — 3. **A. arizonica** (H).

1. Arbutus Menziesii Pursh. Madroña.

Leaves oval or oblong, rounded or contracted into a short point at apex, and rounded, subcordate or cuneate at base, with slightly thickened revolute entire or occasionally on young plants sharply serrate margins, when they unfold light green or often pink, especially on the lower surface, and glabrous or slightly puberulous, and at maturity thick and coriaceous, dark green and lustrous above, pale or often nearly white below, 3′–5′ long and 1½′–3′ wide, with a thick pale midrib and conspicuously reticulated veinlets; persistent until the early summer of their second year and then turning orange and scarlet and falling gradually and irregularly; petioles stout, grooved, ½′–1′ in length, often slightly wing-margined toward the apex; often producing late in summer a second crop of smaller leaves. **Flowers** about ⅓′ long, with a glabrous ovary, appearing from March to May on short slender puberulous pedicels from the axils of acute scarious bracts ciliate on the margins, in spicate pubescent racemes forming a cluster 5′–6′ long and broad. **Fruit** ripening in the autumn, subglobose or occasionally obovoid or oval, ½′ long, bright orange-red, with thin glandular flesh and a 5-celled more or less perfectly developed thin-walled cartilaginous stone; **seeds** several in each cell, tightly pressed together and angled, dark brown and pilose.

A tree, 80°–125° high, with a tall straight trunk 4°–5° in diameter, stout upright or spreading branches forming a narrow oblong or broad round-topped head, and slender branchlets light red, pea-green, or orange-colored and glabrous when they first appear, or on vigorous young plants sometimes covered with pale scattered deciduous hairs, becoming

in their first winter bright reddish brown. **Winter-buds** obtuse, $\frac{1}{3}'$ long, with numerous imbricated broadly-ovate bright brown scales keeled on the back, apiculate at apex, and slightly ciliate. **Bark** of young stems and of the branches smooth, bright red, separating

Fig. 713

into large thin scales, becoming on old trunks $\frac{1}{3}'$–$\frac{1}{2}'$ thick, dark reddish brown, and covered with small thick plate-like scales. **Wood** heavy, hard, strong, close-grained, light brown shaded with red, with thin lighter colored sapwood of 8–12 layers of annual growth; used for furniture and largely for charcoal. The bark is sometimes employed in tanning leather.

Distribution. High well-drained slopes usually in rich soil or ocasionally in gravelly valleys; islands at Seymore Narrows, and southward through the coast region of British Columbia, Washington and Oregon; over the coast ranges of northern California, extending east to Mt. Shasta and south along the western slope of the Sierra Nevada from altitudes of 2500°–4000° to Placer County; on many of the coast ranges south of San Francisco Bay to the mountains of southern California; common and of its largest size in the Redwood-forests of northwestern California; much smaller north of California; rare on the Sierra Nevada and southward except on the Santa Cruz Mountains, and often shrubby in habit.

Occasionally cultivated in the gardens of western and southern Europe.

2. Arbutus texana Buckl. Madroña.

Arbutus xalapensis S. Watson, not H. B. K.

Leaves oval, ovate, or lanceolate, rounded, acute and often apiculate at apex, and rounded or cuneate at base, with slightly thickened usually entire or remotely crenulate-toothed or coarsely serrate margins, often tinged with red when they unfold and pubescent below, and at maturity thick and coriaceous, dark green and glabrous on the upper surface, pale and usually slightly pubescent on the lower surface, 1′–3′ long and $\frac{2}{3}'$–$1\frac{1}{2}'$ wide, with a thick midrib often villose-pubescent below; petioles stout, pubescent, sometimes becoming nearly glabrous, 1′–$1\frac{1}{2}'$ in length. **Flowers** $\frac{1}{4}'$ long, with ciliate calyx-lobes and a pubescent ovary, appearing in March on stout recurved hoary-tomentose club-shaped pedicels from the axils of ovate acute hoary-tomentose often persistent bracts, in compact conic hoary-tomentose panicles $2\frac{1}{2}'$ long. **Fruit** pubescent until half grown, becoming glabrous, usually produced very sparingly, ripening in summer, dark red, $\frac{1}{3}'$ in diameter, with thin granular flesh and a rather thick more or less completely formed stone; **seeds** numerous in each cell, compressed, puberulous.

A tree, in Texas rarely more than 18°–20° high, with a short often crooked trunk 8′–10′ in

diameter, separating a foot or two above the ground into several stout spreading branches, and branchlets light red and thickly coated with pubescence when they first appear, becoming dark red-brown and covered with small plate-like scales; often a broad irregularly shaped bush, with numerous contorted stems. **Winter-buds** about $\frac{1}{8}'$ long, with hoary tomentose scales, the outer ovate, acute, the inner obovate and rounded at apex. **Bark** of young stems and of the branches thin, tinged with red, separating into large papery scales exposing the light red or flesh-colored inner bark, becoming at the base of old trunks sometimes $\frac{1}{4}'$ thick, deeply furrowed, dark reddish brown, and broken into thick square plates. **Wood** heavy, hard, close-grained, brown tinged with red, with a lighter

Fig. 714

colored sapwood of 10–12 layers of annual growth; sometimes used in Texas for the handles of small tools and in the manufacture of mathematical instruments.

Distribution. Texas, dry limestone hills, Travis, Comal, Blanco, Kendall and Bandera Counties, on the Guadalupe and Eagle Mountains, Culberson and El Paso Counties; southeastern New Mexico (Eddy County); on the mountains of Nuevo Leon in the neighborhood of Monterey.

3. Arbutus arizonica Sarg. Madroña.

Leaves lanceolate to rarely oblong, acute or rounded and apiculate at apex, and cuneate or occasionally rounded at base, with thickened entire or rarely denticulate margins, when

Fig. 715

they unfold, tinged with red, and slightly puberulous, especially on the petiole and margins, and at maturity thin, firm and rigid, light green on the upper surface, pale on the lower surface, 1½′–3′ long and ½′–1′ wide, with a slender yellow midrib and obscure reticulate veinlets; appearing in May and after the summer rains in September, and persistent for at least a year; petioles slender, often 1′ in length. **Flowers** ¼′ long, with a corolla much contracted in the middle, and a glabrous porulose ovary, opening in May on short stout hairy pedicels from the axils of conspicuous ovate rounded scarious bracts, in rather loose clusters 2′–2½′ long and broad, their lower branches from the axils of upper leaves. **Fruit** ripening in October and November, globose or short-oblong, dark orange-red, granulate, ⅓′ in diameter, with thin sweetish flesh, and a papery usually incompletely developed stone; **seeds** compressed, puberulous.

A tree, 40°–50° high, with a tall straight trunk 18′–24′ in diameter, stout spreading branches forming a rather compact round-topped head, and thick tortuous divergent branchlets reddish brown and more or less pubescent or light purple, pilose, and covered with a glaucous bloom when they first appear, becoming bright red at the end of their first season, their bark thin, separating freely into thin more or less persistent scales. **Winter-buds** ⅓′ long, red, the two outer scales linear, acuminate a third longer than those of the next rank, acute and apiculate and ridged on the back. **Bark** of young stems and of the branches thin, smooth, dark red, exfoliating in large thin scales, becoming on old trunks ⅓′–½′ thick, irregularly broken by longitudinal furrows and divided into square appressed plate-like light gray or nearly white scales faintly tinged with red on the surface. **Wood** heavy, close-grained, soft and brittle, light brown tinged with red, with lighter colored sapwood of 30–40 layers of annual growth.

Distribution. Dry gravelly benches at altitude of 6000°–8000° on the Santa Catalina and Santa Rita Mountains, southern Arizona, and on the San Luis and Animas Mountains of southwestern New Mexico (Grant County); on the Sierra Nevada of Chihuahua.

7. VACCINIUM L.

Shrubs or rarely small trees, with slender branchlets, and fibrous roots. Leaves thin or coriaceous, deciduous or persistent. Flowers small, on bibracteolate pedicels, in many-branched axillary racemes, or solitary, their bracts small or foliaceous; calyx-tube adnate to the ovary, 4–5-lobed, the lobes valvate in the bud, persistent; corolla epigynous, 4 or 5-toothed, the teeth imbricated in the bud, urceolate-campanulate; stamens 8–10, inserted on the base of the corolla under the thick obscurely lobed epigynous disk; filaments filiform, free, usually hirsute; anthers awned on the back, the cells produced upward into erect spreading tubes dehiscent by a terminal pore; ovary inferior, 4 or 5-celled, the cells sometimes imperfectly divided by the development from the back of a false partition; style filiform, erect; stigma minute; ovules attached to the interior angle of the cell by a 2-lipped placenta, anatropous. Fruit a berry crowned with the calyx-limb, 4 or 5 or imperfectly 8 or 10-celled, the cells many-seeded. Seed minute, compressed, ovoid or reniform; seed-coat crustaceous; embryo clavate, minute, surrounded by fleshy albumen, axile, erect; cotyledons ovate; radicle terete, turned toward the hilum.

Vaccinium with about one hundred species is distributed through the boreal and temperate regions of the northern hemisphere, and occurs within the tropics at high altitudes north and south of the equator. Of the twenty-five or thirty species which occur in North America one is small trees. The fruits of many of the species are edible, the most valuable being the North American *Vaccinium macrocarpum* L., the Cranberry.

Vaccinium is the classical name of one of the Old World species.

1. Vaccinium arboreum Marsh. Farkleberry. Sparkleberry.

Leaves obovate, oblong-oval or occasionally orbicular, acute, or rounded and apiculate at apex, gradually or abruptly cuneate at base, obscurely glandular-dentate or entire, with thickened slightly revolute margins, light red and more or less pilose or puberulous when they unfold, and at maturity coriaceous, dark green and lustrous above, paler below, gla-

brous or often puberulous on the midrib and veins, reticulate-venulose, ½′–2½′ long, ¼′–1′ wide, and sessile or short-petiolate; southward persistent for a year, northward deciduous during the winter. **Flowers** appearing from March to May on slender drooping pedicels

Fig. 716

½′ long, bibracteolate near the middle, with 2 minute acute scarious caducous bractlets, solitary in the axils of leaves of the year or arranged in terminal puberulous racemes 2′–3′ long from the axils of leafy or minute acute scarious bracts; corolla white, open-campanulate, slightly 5-lobed, with acute reflexed lobes, longer than the 10 stamens; filaments hirsute; anther-cells opening by oblique elongated pores. **Fruit** ripening in October, sometimes persistent on the branches until the end of winter, globose, ¼′ in diameter, black and lustrous, with dry glandular slightly astringent flesh of a pleasant flavor.

A tree, 20°–30° high, with a short often crooked trunk occasionally 8′–10′ in diameter, slender more or less contorted branches forming an irregular round-topped head, and slender branchlets light red and covered with pale pubescence when they first appear, glabrous or puberulous and bright red-brown in their first winter, later becoming dark red and marked by minute elevated nearly orbicular leaf-scars; or northward generally reduced to a low shrub, with numerous divergent stems. **Winter-buds** obtuse, nearly $\frac{1}{16}$′ long, with imbricated ovate acute chestnut-brown scales often persistent on the base of the branchlet throughout the season. **Wood** heavy, hard, very close-grained, light brown tinged with red, with thick hardly distinguishable sapwood; sometimes used for the handles of tools and in the manufacture of other small articles. Decoctions of the astringent bark of the root and of the leaves are sometimes employed domestically in the treatment of diarrhœa. The bark has been used by tanners.

Distribution. Usually in moist sandy soil along the banks of ponds and streams; southeastern Virginia and North Carolina, from the coast to the valleys of the high Appalachian Mountains, southward to the valley of the Caloosahatchee River, Florida, through the Gulf states to the shores of Matagorda Bay, Texas, and through eastern Oklahoma, Arkansas, and Missouri to southern Illinois, and the bluffs of White River, near Shoals, Martin County, and near Elizabeth, Harrison County, Indiana; common in the maritime Pine-belt of the south Atlantic and Gulf states, and of its largest size near the coast of eastern Texas; in the interior less abundant and usually of small size. Passing into

Vaccinium arboreum var. glaucescens Sarg.

Batodendron glaucescens Greene

Differing in its glaucescent, pubescent or glabrous leaves, in its usually larger leaf-like bracts of the inflorescence and often in its globose-campanulate corolla.

A tree, 10°–20° high, with a short often crooked trunk, pubescent or glabrous gray branchlets, and winter-buds and bark like those of *Vaccinium arboreum* with which it often grows.

Fig. 717

Distribution. Tunnel Hill, Johnson County, Illinois, southern Missouri to eastern Oklahoma (Sapulpa, Creek County) and through Arkansas to western Louisiana (near Shreveport, Rapides Parish) and eastern Texas to Milam County.

LIV. THEOPHRASTACEÆ.

Trees or shrubs, with watery juice, and entire coriaceous persistent leaves. Flowers perfect, regular; calyx campanulate, with 5 sepals imbricated in the bud; corolla 5-lobed, the lobes imbricated in the bud, with 5 staminodia attached below the sinuses; stamens 5, attached to the base of the corolla-tube, opposite the lobes; ovary 1-celled, with a simple style and a slightly 5-lobed stigma; ovules peltate, numerous, attached to a central fleshy placenta, amphitropous. Fruit baccate, many-seeded. Seeds immersed in the thickened placenta filling the cavity of the fruit; seed-coat membranaceous; embryo surrounded by thick cartilaginous albumen.

A tropical American family of four genera with one species reaching the shores of southern Florida.

1. JACQUINIA Jacq.

Trees or shrubs, with terete or slightly many-angled branchlets, without a terminal bud, and fibrous roots. Leaves often punctate with pellucid dark glands. Flowers on slender ebracteolate pedicels from the axils of minute ovate acute persistent bracts, in terminal or axillary clusters; calyx slightly ciliate on the margins, rounded at apex, persistent under the fruit; corolla hypogynous, the lobes obtuse and spreading, furnished with 5 petal-like ovate obtuse spreading staminodia; stamens inserted on the corolla opposite its lobes near the base of the short tube; filaments flattened, broad at base; anthers oblong or ovoid, attached on the back above the base, extrorse, 2-celled, the cells opening longitudinally; ovary ovoid. Fruit ovoid or subglobose, crowned by the remnants of the persistent style, with a thin crustaceous outer coat, inclosing the thick enlarged mucilaginous placenta. Seeds oblong; seed-coat punctate; embryo eccentric; cotyledons ovate, shorter than the elongated inferior radicle turned toward the broad ventral hilum.

Jacquinia with five or six species is confined to tropical America, with one species reaching southern Florida.

The generic name is in honor of Nicholas Joseph Jacquin (1728–1818) the distinguished Austrian botanist.

1. Jacquinia keyensis Metz. Joe Wood. Sea Myrtle.

Leaves subverticillate, alternate or sometimes opposite, crowded near the end of the branches, cuneate-spatulate or oblong-obovate, rounded or emarginate or often apiculate

at apex, gradually narrowed below, entire, with thickened slightly revolute margins, thick and coriaceous, yellow-green, nearly veinless, with a very obscure midrib, covered on the lower surface with pale dots, 1′–3′ long and ¼′–1′ wide; persistent on the branches until the appearance of the new leaves the following year; petioles short, stout, abruptly enlarged at base. **Flowers** appearing in Florida from November until June, ⅓′ in diameter, pale yellow, fragrant, on slender club-shaped pedicels ½′ long from the axils of minute ovate coriaceous, reddish bracts slightly ciliate on the margins, in terminal and axillary many-flowered glabrous racemes 2′–3′ long; sepals ovate-orbicular, obtuse; corolla salverform, ⅔′ broad, the lobes longer than the tube; stamens shorter than the staminodia. **Fruit** ripening in the autumn, ⅓′ in diameter, orange-red when fully ripe; **seeds** light brown.

A tree, 12°–15° high, with a straight trunk 6′–7′ in diameter, stout rigid spreading branches forming a compact regular round-topped head, and slightly many-angled branchlets yellow-green or light orange-colored and coated with short soft pale ferrugineous pubescence when they first appear, terete, darker and sometimes reddish brown and marked in their second year by orbicular depressed conspicuous leaf-scars and by many scattered pale lenticels, becoming glabrous and red-brown or ashy gray the following season. **Winter-buds** axillary, minute, nearly globose, immersed in the bark. **Bark** of the trunk

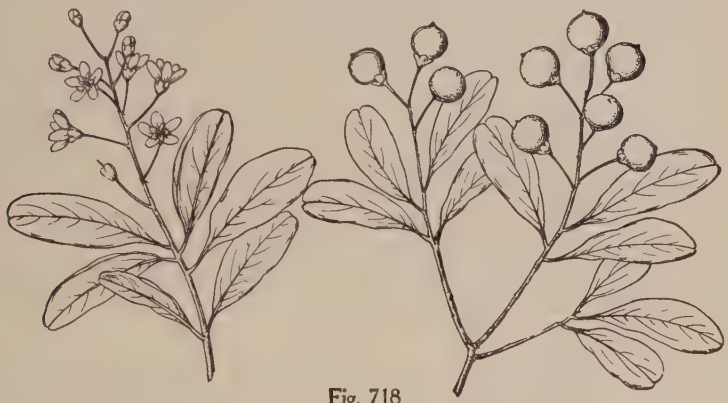

Fig. 718

thin, smooth, blue-gray, and usually more or less marked by pale or nearly white blotches. **Wood** heavy, hard, very close-grained, rich brown, beautifully marked by darker medullary rays.

Distribution. Florida, dry coral soil or silicious sand in the immediate neighborhood of the shore, Gasparilla Island, on the west coast to the southern keys, and to the borders of the Everglades; rare but most abundant and of its largest size in Florida on the Marquesas Keys; on the Bahama Islands and in Cuba and Jamaica.

LV. MYRSINACEÆ.

Trees or shrubs, with watery juice, alternate entire coriaceous punctate leaves, without stipules. Flowers regular, perfect or dimorphous; calyx persistent under the fruit; corolla, without staminodia, glandular-punctate; stamens inserted on the corolla, as many as and opposite its lobes; ovary 1-celled, with an undivided style and a minute terminal stigma; ovules peltate, immersed in the fleshy central placenta, amphitropous. Fruit a drupe. Seed solitary, globose, with copious cartilaginous or corneous albumen; seed-coat membranaceous.

A tropical family of thirty genera, with two arborescent species reaching the shores of southern Florida.

CONSPECTUS OF THE ARBORESCENT GENERA OF THE UNITED STATES.

Flowers perfect in terminal panicles; anthers on short broad filaments; style elongated. **1. Ardisia.**

Flowers dimorphous in small axillary clusters; anthers sessile; stigma sessile or in one form of the staminate flower terminal on a slender style. **2. Rapanea.**

1. ARDISIA Sw.

Glabrous trees or shrubs, with leaves punctate below with immersed resinous dots. Flowers resinous-punctate, pedicellate, the pedicels bibracteolate at base or ebracteolate, in terminal or rarely axillary branched panicles, with minute scarious deciduous or caducous bracts and bractlets; calyx free, 5 or rarely 4-lobed or parted, the divisions contorted or imbricated in the bud; corolla 5 or rarely 4–6-parted, the divisions extrorsely or sinistrorsely contorted in the bud, short or elongated, white or rose color; stamens exserted; filaments short or nearly obsolete, free, inserted on the throat of the corolla; anthers usually sagittate-lanceolate, attached on the back just above the base, introrse, 2-celled, the cells opening longitudinally sometimes nearly to the base; ovary globose; ovules numerous, immersed in the globose resinous-punctate placenta. Fruit globose, with thin usually dry flesh and a 1-seeded stone with a usually crustaceous or bony shell. Seed concave or more or less lobed at base, resinous-punctate; hilum basilar, concave, conspicuous; embryo cylindric, transverse; cotyledons flat on the inner face, rounded on the back, shorter than the slender radicle.

Ardisia with about two hundred species inhabits tropical and subtropical regions of the two hemispheres. The genus has few useful properties, but a number of species are cultivated for the beauty of their handsome evergreen foliage and bright-colored fruits.

The generic name is from ἀρδις, in reference to the pointed anthers.

1. Ardisia escallonioides Cham. & Schlecht. Marlberry. Cherry.

Icacorea paniculata Sudw. *Ardisia paniculata* Nutt.

Leaves ovate to oblong-lanceolate or lanceolate-obovate, acute or rounded at the narrow apex, cuneate and gradually contracted at base, entire, with thickened and slightly revo-

Fig. 719

lute margins, thick and coriaceous, glabrous, marked by minute scattered dark dots, dark yellow-green on the upper surface, pale on the lower surface, 3′–6′ long and 1′–1½′ wide, with a broad midrib yellow and conspicuous on the under side, slender primary veins and reticulate veinlets; appearing in the summer or early autumn and falling before the appear-

ance of the flowers the following year; petioles stout, grooved, $\frac{1}{4}'$–$\frac{1}{2}'$ in length. **Flowers** fragrant, usually opening in November or occasionally as early as July, $\frac{1}{4}'$ in diameter, on slender elongated pedicels without bractlets, from the axils of linear acute caducous bracts, in terminal rusty brown puberulous panicles 3′–4′ long and broad, their lower branches often from the axils of upper leaves; calyx ovoid, divided nearly to the base into 5 ovate acute lobes scarious and ciliate on the margins and marked on the back with dark lines; corolla 5-parted, with oblong rounded divisions sinistrorsely overlapping, or with 1 lobe wholly outside and 1 inside in the bud, conspicuously marked with red spots on the inner surface near the base, becoming reflexed; stamens, with short broad filaments, contracted by a geniculate fold in the middle, and large orange-colored anthers longer than the filaments, their cells opening almost to the base; ovary globose, glandular, gradually contracted into a long slender style ending in a simple stigma. **Fruit** ripening in early spring, globose, $\frac{1}{4}'$ in diameter, tipped with the remnants of the style, and roughened by resinous glands, dark brown at first when fully grown, ultimately becoming black and lustrous; stone brown, thin-walled, crustaceous; **seed** conspicuously lobed at base, bright red-brown, about $\frac{1}{8}'$ in diameter.

A slender tree, in Florida rarely more than 20° high, with a short trunk 4′–5′ in diameter, numerous thin upright branches forming a narrow head, and stout terete often contorted branchlets, rusty brown or dark orange-colored and slightly puberulous when they first appear, becoming in their second year dark brown or ashy gray, and marked by many minute circular lenticels and by thin nearly orbicular flat leaf-scars displaying in the centre a group of fibro-vascular bundle-scars. **Winter-buds** rusty brown; terminal slender, acuminate, $\frac{1}{8}'$–$\frac{1}{4}'$ long; axillary globose, minute, nearly immersed in the bark. **Bark** of the trunk about $\frac{1}{8}'$ thick, light gray or nearly white, roughened by minute lenticels, and separating into large thin papery plates. **Wood** heavy, hard, very close-grained, rich brown beautifully marked by darker medullary rays, with thick lighter colored sapwood.

Distribution. Florida, usually in low damp hammocks, from Mosquito Inlet to the southern keys on the east coast, and from the shores of the Caloosahatchee River to Cape Romano on the west coast, ranging northward in the interior to Lake Okeechobee (*R. M. Harper*); usually a shrub, occasionally arborescent on the shores of Bay Biscayne and on some of the southern keys; on the Bahama Islands, in Cuba, and southern Mexico.

2. RAPANEA Aubl.

Trees or shrubs, with watery juices and terete branchlets. Leaves alternate, entire or rarely dentate, usually distinctly lepidote, persistent, without stipules. Flowers perfect or unisexual by abortion, minute, 4 or 5, or rarely 6 or 7-merous, sessile or pedicellate, in small axillary sessile or pedunculate fascicles, their bracts deciduous; calyx free, persistent, the sepals imbricate-valvate in the bud, ciliate, usually glandular-punctate; corolla hypogynous, the lobes more or less connate at base, ovate or elliptic, spreading or recurved, glandular-punctate, papillate on the margins, imbricate or rarely convolute in the bud; stamens inserted on the base of the corolla opposite its lobes; filaments 0; anthers short, connate to the corolla, acuminate and papillate at apex, introrse, 2-celled, the cells opening longitudinally; ovary globose or ellipsoidal, 1-celled; stigma capitate, irregularly lobed; ovules few, peltate, immersed in one series near the middle of the free fleshy globose placenta. Fruit dry or fleshy, seed filling the cavity of the fruit, globose, intruded at base; testa thin; albumen copious, corneous, rarely slightly ruminate; embryo cylindric, elongated, transverse, usually curved; cotyledons small, radicle elongated.

Rapanea, with nearly one hundred and fifty species, is widely distributed through the tropical and subtropical regions of the two hemispheres, one species reaching southern Florida.

The generic name is formed from the native name of *Rapanea guianensis* in British Guiana.

1. Rapanea guianensis Aubl.

Leaves crowded at the end of the branches, oblong-obovate, obtuse or retuse at apex, gradually narrowed and contracted at base, coriaceous, bright green and lustrous on the

upper surface, paler on the lower surface, $2\frac{3}{4}'$–$3\frac{1}{2}'$ long and $1'$–$1\frac{1}{2}'$ wide, with thickened revolute margins, a thick midrib and obscure veins; petioles stout, narrowly wing-margined, $\frac{1}{4}'$–$\frac{1}{3}'$ in length. **Flowers** in November, minute, short-pedicellate in short pedunculate clus-

Fig. 720

ters usually 5, rarely 4-merous, white more or less marked with purple, about $\frac{1}{6}'$ in diameter; calyx divided to the middle, the lobes broad-ovate, acute or rounded at apex, slightly ciliate, persistent under the fruit; corolla 2 or 3 times longer than the calyx, the lobes spreading, narrowed and rounded at apex, slightly ciliate on the margins; staminate flowers dimorphous; anthers sagittate-apiculate, inserted below the middle of the petals; ovary in one form crowned by a minute discoid sessile stigma and probably abortive, in the other form gradually narrowed into a slender style, terminating in an oblique stigma and fertile; pistillate flowers, anthers smaller and rudimentary; ovary crowned by a large nearly sessile irregularly lobed papillate stigma deciduous from the fruit. **Fruit** in clusters crowded on the elongated somewhat thickened spur-like peduncle of the flower-cluster covered with imbricated persistent bracts, dark blue or nearly black, tipped with the persistent style, $\frac{1}{6}'$–$\frac{1}{5}'$ in diameter; exocarp thin and fleshy; endocarp crustaceous, white.

A tree, in Florida occasionally 18°–20° high, with a tall usually more or less crooked trunk $2'$–$3'$ in diameter, small ascending branches forming an open irregular head, and slender gray or light red-brown branchlets roughened for a year or two by the persistent spur-like peduncles of the fallen fruit and later marked by circular scars in the axils of the small transverse leaf-scars; more often a shrub. **Bark** of the trunk thin, close, pale gray.

Distribution. Florida, usually in low damp hammocks, shores of Indian River on the east coast and Palmetto, Manatee County, on the west coast, southward to the southern keys, ranging in the interior northward to Lake Okeechobee; common; on the Bahama Islands, Cuba, Porto Rico, Jamaica and Trinidad, to southern Brazil, and to Mexico and Bolivia.

LVI. SAPOTACEÆ.

Trees or shrubs, with milky juice. Leaves alternate, simple, entire, pinnately veined, mostly coriaceous, petiolate, without stipules. Flowers perfect, regular, small, in axillary clusters; calyx of 5–8 sepals imbricated in the bud, persistent under the fruit; corolla hypogynous, 5–8-cleft, the divisions imbricated in the bud, often with as many or twice as

many internal appendages borne on its throat; disk 0; fertile stamens as many as and opposite the divisions of the corolla and inserted on its short tube, often with sterile filaments (*staminodia*) alternate with them; anthers generally extrorse, 2-celled, the cells opening longitudinally; pistil of united carpels; ovary sessile, usually 5-celled; style simple; ovules solitary in each cell, attached to an axile placenta, ascending, anatropous; raphe ventral; micropyle inferior. Fruit baccate, bearing at apex the remnant of the style, usually 1-celled and 1-seeded. Seed with or without albumen; embryo large; radicle terete, inferior.

This family with fifty genera is chiefly tropical and subtropical, with only Bumelia extending in North America into temperate regions. Some of the species produce valuable timber or edible and agreeable fruits. From *Palaquium gutta* Burkh., of the Malay Peninsula, gutta-percha is obtained. Five genera are represented by trees in the flora of the United States.

CONSPECTUS OF THE GENERA OF THE UNITED STATES.

Calyx of 5 sepals in a single series.
- Staminodia 1 in each sinus of the corolla.
  - Appendages of the corolla 0; staminodia slender, scale-like. 1. **Sideroxylum.**
  - Appendages of the corolla present; staminodia petaloid.
    - Staminodia linear, fimbriate; seeds, with copious albumen. 2. **Dipholis.**
    - Staminodia petaloid, entire or denticulate; seeds, without albumen. 3. **Bumelia.**
- Staminodia and appendages of the corolla 0; leaves covered below with lustrous copper-colored or golden pubescence. 4. **Chrysophyllum.**

Calyx of 6–8 sepals in 2 series; corolla 6–8-lobed, with 2 appendages in each sinus inside of a scale-like or petaloid staminodia. 5. **Mimusops.**

1. SIDEROXYLUM L.

Trees, with terete branchlets, naked buds, and long-petiolate persistent leaves, the veins remote and connected by reticulate veinlets. Flowers minute, on ebracteolate pedicels from the axils of minute deciduous bracts, in crowded many-flowered axillary fascicles; calyx 5-parted, the divisions in one series, nearly equal, corolla furnished with 5 or 6 staminodia, and 5 or rarely 6-lobed; filaments slender, elongated, bent outward at the apex; anthers oblong, the cells at first extrorse, sometimes becoming sublateral; staminodia linear, scale-like; ovary contracted into a subulate style tipped with a minute slightly 5-lobed stigma. Fruit dry, 1-seeded, oblong, with thin coriaceous flesh. Seed obovoid or oblong; seed-coat lustrous, light brown, folded on the inner face into 2 obscure lobes rounded at apex; hilum elevated, subbasilar or lateral, oblong or linear; embryo erect in thick fleshy albumen; radicle much shorter than the oblong fleshy cotyledons.

Sideroxylum with a hundred species is widely distributed through the tropics of the two hemispheres, and occurs also with a few species in Australia, Madeira, southern Africa, New Zealand, and Norfolk Island, a single species reaching the shores of southern Florida. Some of the species are large and valuable timber-trees, producing hard handsome durable wood.

The generic name, from σίδηρος and ξύλον, is in reference to the hardness of the wood.

1. Sideroxylum fœtidissimum Jacq. Mastic.

Sideroxylum Mastichodendron Jacq.

Leaves mostly clustered near the end of the branches, appearing irregularly from early spring until autumn, oval, acute or rounded and slightly emarginate at apex, and gradually narrowed at base, with thickened cartilaginous slightly involute margins, silky-canescent beneath when they unfold, and at maturity thin and firm, glabrous, bright green and lustrous above, lustrous and yellow-green below, 3′–5′ long and 1½′–2′ wide, with a broad pale conspicuous midrib deeply impressed on the upper side and inconspicuous primary veins arcuate near the margins; petioles slender, 1′–1½′ in length. **Flowers** usually appearing in Florida in the autumn and also in early spring and during the summer on stout orange-

colored puberulous pedicels from the axils of minute acute scarious bracts usually deciduous before the opening of the flower-buds, from the axils of young leaves or on the branches of the previous year from leafless nodes; calyx yellow-green, puberulous on the outer surface and deeply divided into broad-ovate rounded lobes rather shorter than the oblong-ovate rounded divisions of the light yellow corolla; staminodia lanceolate, nearly entire, tipped with a subulate point and much shorter than the stamens; ovary oblong-ovoid, glabrous, gradually contracted into an elongated style stigmatic at apex. **Fruit** ripening in March and April on a much thickened woody stem erect or nearly at right angles to the branch, 1′

Fig. 721

long, separating from the calyx in falling, with tough yellow skin, and thick juicy flesh of a pleasant subacid flavor; **seed** obovoid, rounded above, narrowed at base, $\frac{1}{2}'$ long and $\frac{1}{3}'$ wide.

A tree, in Florida 60°–70° high, with a massive straight trunk 3°–4° in diameter, stout upright branches forming a dense irregular head, and thick terete branchlets orange-colored and slightly puberulous when they first appear, becoming glabrous, brown more or less tinged with red, and marked by the conspicuous nearly orbicular leaf-scars displaying 3 large fibro-vascular bundle-scars, and conspicuously roughened by the thickened persistent bases of the fruit stalks. **Bark** of the trunk $\frac{1}{3}'$–$\frac{1}{2}'$ thick, dark gray to light brown tinged with red and broken into thick plate-like scales separating into thin layers. **Wood** heavy, hard, strong, bright orange-colored, with thick yellow sapwood of 40–50 layers of annual growth; in Florida used in boat-building.

Distribution. Florida, Cape Canaveral and Cape Romano to the southern keys; on the Bahama Islands and many of the Antilles.

2. DIPHOLIS A. DC.

Trees or shrubs, with naked buds, and persistent leaves, the slender veins arcuate and united near the margins. Flowers minute, on clavate ebracteolate pedicels from the axils of minute deciduous bracts, in the axils of existing leaves or from the leafless nodes of previous years; calyx ovoid, deeply 5-lobed, the lobes nearly equal, ovate, rounded at apex; corolla campanulate, white, 5-lobed, the spreading lobes furnished on each side at the base with a linear or subulate appendage; stamens exserted; filaments filiform; anthers oblong-sagittate, extrorse; staminodia 5, petaloid, ovate, acute, fimbriately cut on the margins, oblique, keeled on the back, inserted in the same rank and alternate with the stamens; ovary oblong or narrow-ovoid, gradually contracted into a slender style shorter than the corolla and stigmatic at the apiculate apex. Fruit oblong-ovoid, with thin dry flesh.

Seed ovoid; seed-coat thick, coriaceous and lustrous; hilum oblong, basilar or slightly lateral; embryo erect in thick fleshy albumen; cotyledons ovate, flat, much longer than the short radicle turned toward the hilum.

Dipholis with three species is confined to the West Indies and southern Florida.

The generic name, from δίς and φολίς, relates to the appendages of the corolla.

1. Dipholis salicifolia A. DC. Bustic. Cassada.

Leaves oblong-lanceolate or narrow-obovate, acute, acuminate, or rounded at apex, gradually contracted at base, with slightly thickened cartilaginous wavy margins, thickly coated when they unfold with lustrous rufous pubescence, and at maturity thin and firm, dark green and lustrous above, pale yellow-green below, 3′–5′ long, ½′–1½′ wide, and glabrous, or slightly puberulous on the lower side of the narrow pale midrib, with inconspicuous veins and reticulate veinlets; appearing in Florida in the spring and remaining on the branches between one and two years; petioles slender, ½′–1′ in length. **Flowers** opening during March and April, ⅛′ long, on thick pedicels ¼′ in length from the axils of minute ovate acute scarious bracts, and coated with rufous pubescence, in dense many-flowered fascicles crowded on branchlets of the year or of the previous year for a distance of 8′–12′; calyx half the length of the corolla, coated on the outer surface with rusty silky pubescence; appendages of the corolla as long as the oval acute irregularly toothed staminodia; ovary narrow-ovoid, glabrous, gradually contracted into a slender style shorter than the corolla and stigmatic at apex. **Fruit** solitary or rarely clustered, ripening in the autumn, short-oblong to subglobose, black, ¼′ in length; **seed** pale brown, about $\frac{3}{16}$′ in length.

A tree, in Florida sometimes 40°–50° high, with a straight trunk 18′–20′ in diameter, small upright branches forming a narrow graceful head, and slender branchlets coated with

Fig. 722

rufous pubescence when they first appear, becoming ashy gray or light brown tinged with red and marked by numerous circular pale lenticels and by small elevated orbicular leaf-scars displaying near the centre a compact cluster of fibro-vascular bundle-scars. **Bark** of the trunk about ⅓′ thick and broken into thick square plate-like brown scales tinged with red. **Wood** very heavy, exceedingly hard, strong, close-grained, dark brown or red, with thin sapwood of 4 or 5 layers of annual growth.

Distribution. Florida, rich hummock soil, shores of Bay Biscayne and on the Everglade Keys, Dade County, and on several of the southern keys; on the Bahama Islands and on many of the Antilles.

3. BUMELIA Sw.

Small trees or shrubs, with terete usually spinescent branchlets, scaly buds, and fibrous roots. Leaves often fascicled on spur-like lateral branchlets, conduplicate in the bud, coriaceous or thin, short-petiolate, obovate and obtuse or elliptic, silky-pubescent or tomentose below, or nearly glabrous, with rather inconspicuous veins arcuate near the entire margins and conspicuous reticulate veinlets, deciduous or persistent. Flowers minute, on slender clavate ebracteolate pedicels from the axils of lanceolate acute scarious deciduous bracts, in many-flowered crowded fascicles in the axils of existing leaves or from the leafless nodes of previous years; calyx ovoid to subcampanulate, 5-lobed, the lobes in one series, imbricated in the bud, ovate or oblong, rounded at apex, nearly equal; corolla campanulate, white, with 5 spreading broad-ovate lobes rounded at apex and furnished on each side at base with a minute acute ovate or lanceolate appendage; stamens 5; filaments filiform; anthers ovoid-sagittate, attached on the back below the middle, the cells opening by subextrorse slits; staminodia petal-like, ovate or ovate-lanceolate, entire or obscurely denticulate, flattened or keeled on the back, sometimes furnished at base with a pair of minute scales; ovary hirsute, ovoid to ovoid-conic, gradually or abruptly contracted into a slender short or elongated simple style stigmatic at the acute apex. Fruit oblong-obovoid or globose, black, solitary or in 2 or 3-fruited clusters: flesh thin and dry or succulent. Seed ovoid or oblong, apiculate or rounded at apex, without albumen; seed-coat thick, crustaceous, light brown, smooth and shining, folded more or less conspicuously on the back into 2 lobes rounded at apex; embryo filling the cavity of the seed; cotyledons thick and fleshy, hemispheric, usually consolidated; radicle short, turned toward the basilar or subbasilar orbicular or elliptic hilum.

Bumelia, with about twenty-five species is confined to the New World, where it is distributed from the southern United States through the West Indies to Mexico, Central America, and Brazil. Of the twelve species in the United States which have been distinguished five are small trees.

Bumelia produces hard heavy strong wood, that of the North American species containing bands of numerous large open ducts defining the layers of annual growth and connected by conspicuous branched groups of similar ducts, presenting in cross-section a reticulate appearance.

The generic name is from *βουμελία*, a classical name of the Ash-tree.

CONSPECTUS OF THE ARBORESCENT SPECIES OF THE UNITED STATES.

Lower surface of the leaves pubescent or lanuginose.

Leaves short-obovate to oblanceolate or elliptic, covered below with pale or ferrugineous silky pubescence. **1. B. tenax** (C).

Leaves oblong-obovate, lanuginose below with ferrugineous or silvery white hairs. **2. B. lanuginosa** (A, C, H).

Leaves glabrous or nearly so.

Leaves deciduous.

Leaves oblong-obovate, thick. **3. B. monticola.**

Leaves elliptic to oblanceolate, usually acute or acuminate, thin. **4. B. lycioides** (A, C).

Leaves persistent, obovate; fruit oblong. **5. B. angustifolia** (C, D).

1. Bumelia tenax Willd. Ironwood. Black Haw.

Leaves oblong-obovate to oblanceolate or elliptic, rarely oval or ovate on leading shoots, rounded or acute at apex, cuneate at base, thin, dark dull green, and finally reticulate-venulose on the upper surface, thickly covered below with soft silky pale or gold-colored pubescence, usually becoming dark rusty brown by midsummer, 1′–3′ long and $1\frac{1}{8}$′–$1\frac{1}{2}$′ wide, with slightly thickened and revolute margins and a prominent midrib; turning yellow and falling irregularly during the winter; petioles slender, hairy, grooved, $\frac{1}{4}$′–1′ in length. **Flowers** appearing from May in Florida to July in South Carolina, $\frac{1}{8}$′ long, on

pedicels ½′–1′ in length and coated like the calyx with rufous silky pubescence, in many-flowered crowded fascicles; calyx ovoid, with oblong lobes; appendages of the corolla large, ovate, acute, crenate, shorter than the ovate staminodia about as long as the lobes of the

Fig. 723

corolla; ovary narrow-ovoid, gradually contracted into an elongated style. **Fruit** ripening and falling in the autumn, short-oblong to ellipsoid, ⅓′–½′ in length; flesh sweet and edible; **seed** oblong, short-pointed at apex, ¼′–⅓′ long.

A tree, 20°–30° high, with a trunk occasionally 5′–6′ in diameter, straight spreading flexible tough branches unarmed or armed with straight stout rigid spines sometimes 1′ in length, and slender branchlets coated when they first appear with silky pale pubescence often tinged with red and soon rusty brown, becoming glabrous before winter, and then dark red and slightly roughened by occasional minute dark lenticels; or often a shrub only a few feet high. **Winter-buds** minute, subglobose, with imbricated ovate scales rounded at apex and clothed with rusty brown tomentum. **Bark** of the trunk thick, brown tinged with red, and divided irregularly by deep fissures into narrow flat reticulate ridges covered with minute appressed scales. **Wood** heavy, hard, close-grained, light brown streaked with white, with lighter colored sapwood.

Distribution. Dry sandy soil; South Carolina (Saint Helena Island and Bluffton, Beaufort County), southward in the coast region of Georgia and east Florida to Cape Canaveral and through the interior of the peninsular to Cedar Keys on the west coast; near Bainbridge, Decatur County, southwestern Georgia.

2. Bumelia lanuginosa Pers. Gum Elastic. Chittam Wood.

Leaves oblong-obovate, rounded and often apiculate at apex and gradually narrowed at base, coated when they unfold with pale ferrugineous tomentum dense on the lower and loose on the upper surface, and at maturity thin and firm, dark green and lustrous above, more or less lanuginose below with rusty brown or silvery white (var. *albicans* Sarg.) hairs, 1′–2½′ long and ⅓′–¾′ wide; falling irregularly during the winter; petioles slender, rusty brown or pale pubescent, ⅛′–¾′ in length. **Flowers** opening in summer on hairy pedicels ⅛′ in length, in 16–18-flowered fascicles; calyx ovoid, with ovate rounded lobes coated on the outer surface with ferrugineous or pale tomentum and rather shorter than the tube of the corolla; appendages of the corolla small, ovate and acute; staminodia ovate, acute, remotely and slightly denticulate, as long as the corolla-lobes; ovary abruptly contracted into a slender elongated style. **Fruit** on a slender drooping stalk ripening and falling in the autumn, oblong or slightly obovoid, ½′ long, with thick flesh; **seed** short-oblong, rounded at apex, about ¼′ in length.

A tree, often 40°–50° high, with a tall straight trunk 1°–2° in diameter, short thick rigid

branches forming a narrow-oblong round-topped head, unarmed, or armed with stout rigid straight or slightly curved spines frequently developing into spinescent leafy lateral branchlets, and slender often somewhat zigzag branchlets coated with thick rufous or pale tomentum when they first appear, becoming in their first winter red-brown to ashy gray and glabrous or nearly so, and marked by occasional minute lenticels and by small semi-orbicular leaf-scars displaying 2 clusters of fibro-vascular bundle-scars; of its largest size in the Texas coast region; much smaller east of the Mississippi River, and there rarely more than 20° tall. **Winter-buds** obtuse, $\frac{1}{8}'$ long, covered with broad-obovate rusty-tomentose scales. **Bark** of the trunk $\frac{1}{2}'$ thick, dark gray-brown and usually divided into narrow ridges

Fig. 724

broken into thick appressed scales. **Wood** heavy, rather soft, not strong, close-grained, light brown or yellow, with thick lighter colored sapwood; producing in Texas considerable quantities of clear viscid gum from the freshly cut wood.

Distribution. Southern and southeastern Georgia, western Florida southward to the neighborhood of Lake City, Columbia County and to Cedar Key, coast of Alabama and inland to Dallas County, southern Mississippi, Louisiana, and Texas to the valley of the San Antonio River and over the Edwards Plateau (Kendall, Kerr and Brown Counties) to the valley of the upper Brazos River (Palo Pinto County), and northward through western Louisiana and Arkansas to western Oklahoma (Seiling, Dewey County), and to southeastern Kansas (Cherokee County) and southern Missouri as far north as the valley of the Meramec River (near Allenton, St. Louis County), and southern Illinois; at Calcasieu Pass, on the sandy beaches of the Louisiana coast forming thickets of plants 6°–8° high, and uninjured by salt spray; the var. *albicans* in eastern Texas from the valley of the lower Brazos to that of the San Antonio River and in the neighborhood of Monterey, Nuevo Leon; most distinct and of its largest size on the bottoms of the Guadalupe River, near Victoria, Victoria County, and here occasionally 70°–80° high, with a trunk 3° in diameter.

Passing into the var. *rigida* A. Gray, with smaller rather narrower leaves and often more spinescent branches. Brown and Uvalde Counties, Texas; in Coahua and Nuevo Leon, and in the cañons of the mountains of southern Arizona up to altitudes of at least 4000°–5000°; in Texas shrubby in habit; in Arizona forming dense thickets of slender stems often 20°–25° tall and only 2′–3′ in diameter.

3. Bumelia monticola Buckl.

Leaves oblong-obovate, narrowed and acute or rounded and rarely slightly emarginate at apex, cuneate at base, entire, covered above with matted pale hairs and densely below

with snow white pubescence when they unfold, and at maturity coriaceous, dark yellow-green, lustrous and glabrous on the upper surface, paler on the lower surface, $1\frac{1}{4}'$–$3'$ long and $\frac{1}{3}'$–$1\frac{1}{4}'$ wide, with slightly revolute margins, a slender yellow midrib glabrous or slightly pubescent below toward the base and conspicuous reticulate veinlets, deciduous; petioles slender pubescent early in the season, becoming glabrous. **Flowers** opening from the middle of June to the middle of July, on villose pedicels, becoming sometimes nearly glabrous in the autumn, $\frac{1}{8}'$–$\frac{1}{4}'$ in length; calyx pale green, villose-pubescent, its lobes ovate, ciliate on the margins, shorter than the lobes of the corolla, their appendages lanceolate; staminodia rounded at apex, longer than the corolla-lobes. **Fruit** ripening in September, subglobose to oblong-obovoid, $\frac{1}{4}'$–$\frac{1}{3}'$ long and $\frac{1}{4}'$–$\frac{1}{3}'$ in diameter; seed oblong, rounded at the ends, about $\frac{2}{5}'$ long.

A tree, in favorable positions 20°–25° high, with spinose branches forming an irregular open head, and slender often zigzag red-brown lustrous branchlets, the lateral branchlets

Fig. 725

often ending in stout spines; more often an irregularly branched shrub 10°–15° high, spreading on the banks of streams into great thickets. **Bark** of the trunk thick, pale and dark gray, rough and scaly, exfoliating in large scales.

Distribution. Texas, dry limestone cliffs and cañon bottoms and by streams dry during a large part of the year, valley of the upper Guadalupe River (Comal, Kendall and Kerr Counties) to the valley of the Rio Grande (Uvalde County), and northward to the valley of the upper Brazos River (Palo Pinto County); in Cohahuila (near Saltillo).

4. Bumelia lycioides Gærtn. f. Ironwood. Buckthorn.

Leaves elliptic to oblanceolate, acute, acuminate, or rarely rounded at apex, gradually narrowed at base, covered when they unfold especially below with silky villose pubescence, soon glabrous, and at maturity bright green and glabrous on the upper surface, light green and sometimes coated on the lower surface with pale pubescence, thin and rather firm, finely reticulate-venulose, $3'$–$6'$ long and $\frac{1}{2}'$–$2'$ wide, with a pale thin conspicuous midrib sometimes slightly pubescent below near the base, deciduous in the autumn; petioles slender, slightly grooved, mostly pubescent early in the season, usually becoming glabrous, $\frac{1}{2}'$–$1'$ in length. **Flowers** appearing at midsummer on slender glabrous pedicels $\frac{1}{2}'$ long, in crowded many-flowered fascicles; calyx glabrous, ovoid-campanulate, with rounded lobes rather shorter than the corolla; staminodia broad-ovate, denticulate, nearly as long as the narrow appendages; ovary ovoid, slightly hairy toward the base only, gradually contracted into a short thick style. **Fruit** ripening and falling in the autumn, ovoid or obovoid, about

$\frac{2}{3}'$ in length; flesh thick; **seed** short-oblong to subglobose, rounded at apex, nearly $\frac{1}{4}'$ long, with a pale conspicuous hilum.

A tree, 25°–30° high, with a short trunk rarely more than 6′ in diameter, stout flexible branches usually unarmed or furnished with short stout slightly curved spines occasionally

Fig. 726

developing into leafy spinescent branches, and short thick spur-like lateral branchlets slightly puberulous when they first appear, soon becoming glabrous, light red-brown, rather lustrous, and marked by numerous pale lenticels, and in their second year dark or light brown tinged with red or ashy gray. **Winter-buds** minute, obtuse, nearly immersed in the bark, with pale dark brown glabrous scales. **Bark** of the trunk thin, light red-brown, the generally smooth surface broken into small thin persistent scales. **Wood** heavy, hard, not strong, close-grained, light brown or yellow, with thick lighter colored sapwood.

Distribution. Usually in low moist soil on the borders of swamps and streams; rocky bluffs of the Ohio River near Cannelton, Perry County, southern Indiana, southern Illinois (Hardin, Pope and Pulaski Counties), to southeastern Missouri (Butler County) and to western Kentucky, western and central Tennessee, central Mississippi and northern Louisiana (West Feliciana Parish); and through Arkansas (Helena, Phillips County, and McNab, Hempstead County) to the coast region of eastern Texas (Beaumont, Jefferson County, and Columbia, Brazoria County); central Alabama; Florida southward to St. Mark's, Wakulla County, and to Taylor, Alachua and Volusia Counties, and to northwestern Georgia (Catoosa County), and the valley of the Savannah River in Georgia and South Carolina, and northward through eastern North Carolina to southeastern Virginia (Norfolk County).

5. Bumelia angustifolia Nutt. Ants' Wood. Downward Plum.

Leaves obovate, rounded at apex, and gradually narrowed and cuneate at base, with slightly thickened revolute margins, glabrous, thick and coriaceous, pale blue-green on the upper surface, paler on the lower surface, $1'–1\frac{1}{2}'$ long and $\frac{1}{4}'–1\frac{1}{4}'$ wide, with a pale slender midrib, and very obscure veins and veinlets; usually persistent on the branches until the end of their second winter; petioles stout, grooved, rarely $\frac{1}{4}'$ in length. **Flowers** generally appearing in October and November, on slender glabrous pedicels seldom more than $\frac{1}{2}'$ in length, in few or many-flowered crowded fascicles; calyx glabrous, divided nearly to the base into narrow-ovate lobes rounded at apex and half as long as the divisions of the corolla furnished with linear-lanceolate appendages as long as the ovate acute denticulate staminodia; ovary narrow-ovoid, slightly hairy at base only, gradually contracted into an elongated style. **Fruit** ripening in the spring, on slender drooping stems, usually 1 fruit only

being developed from a fascicle of flowers, oblong or slightly obovoid, rounded at the ends, $\frac{1}{2}'$–$\frac{3}{4}'$ long and $\frac{1}{4}'$ in diameter, with thick sweet flesh; **seed** oblong, rounded at apex, $\frac{1}{2}'$ long.

A tree, sometimes 20° high, with a short trunk rarely exceeding 6′–8′ in diameter, graceful pendulous branches forming a compact round head, and rigid spinescent divergent lateral branchlets often armed with acute slender spines sometimes 1′ in length, and when they first appear thickly coated with loose pale or dark brown deciduous tomentum, becoming light brown tinged with red or ashy gray. **Winter-buds** ovoid, acute, and covered with rufous tomentum. **Bark** of the trunk $\frac{1}{3}'$–$\frac{1}{2}'$ thick, gray tinged with red, and deeply

Fig. 727

divided by longitudinal and cross fissures into oblong or nearly square plates. **Wood** heavy, hard, although not strong, very close-grained, light brown or orange-colored, with thick lighter colored sapwood.

Distribution. Florida, shores of Indian River to the southern keys, and on the west coast from Cedar Keys to East Cape, and here less abundant and usually on rocky shores and in the interior of low barren islands; on the Bahama Islands and in Cuba.

4. CHRYSOPHYLLUM L.

Trees, with terete branchlets usually coated while young with dense tomentum, and naked buds. Leaves short-petiolate, bright green and glabrous on the upper surface and coated on the lower surface with brilliant silky pubescence or tomentum, persistent. Flowers on pedicels from the axils of minute acute bracts, in dense many-flowered fascicles; calyx usually 5-parted, the divisions nearly equal, obtuse; corolla 5 or rarely 6 or 7-lobed, tubular, campanulate or subrotate, white or greenish white; filaments short, subulate or filiform, enlarged into broad connectives; anthers ovoid or triangular, extrorse or rarely partly introrse, the cells spreading below; ovary usually 5-celled, style crowned by a 5-lobed stigma. Fruit short-oblong, ovoid or globose. Seed ovoid; seed-coat coriaceous, dull or lustrous; hilum subbasilar, elongated, conspicuous; embryo erect, surrounded by more or less pungent fleshy albumen; cotyledons oblong, foliaceous.

Chrysophyllum is tropical, with fifty or sixty species most abundant in the New World, with a small number of species in western and southern tropical Africa, southern Asia, Australia, and the Hawaiian Islands, and with one species in southern Florida. The most valuable species, *Chrysophyllum Cainito* L., a native of the West Indies and now cultivated in all tropical countries and naturalized in many parts of Central and South America, produces the so-called star-apple, a succulent edible blue or purple and green fruit the size and shape of a small apple.

The generic name, from *χρυσός* and *φύλλον* is in allusion to the golden covering of the under surface of the leaves.

1. Chrysophyllum oliviforme Lam. Satin-leaf.

Leaves revolute in the bud, oval, acute or contracted into a short broad point or sometimes rounded at apex, abruptly cuneate at base, thick and coriaceous, bright blue-green on the upper surface and covered on the lower surface and on the petiole with brilliant copper-colored pubescence, 2′–3′ long and 1½′–2′ wide, with a broad prominent midrib deeply impressed on the upper side and numerous straight veins arcuate near the margins; petioles stout, ½′–⅔′ in length. **Flowers** appearing in Florida irregularly throughout the year and often found on a branch with ripe or half-grown fruits, on stout pedicels shorter than the petioles, covered like the calyx with rufous tomentum, in few or many-flowered fascicles in the axils of leaves or at the base of lateral branchlets in those of earlier years; calyx divided nearly to the base into broad rounded lobes rather shorter than the tube of the subrotate white corolla with short spreading rounded lobes; ovary 5-celled, pubescent, gradually contracted into a short style crowned by a broad 5-lobed stigma. **Fruit** usually 1-seeded by abortion, on stems 1′ long, usually only a single fruit being produced from a flower-cluster, ovoid or sometimes nearly globose, dark purple, roughened by occasional excrescences, with a thick tough skin inclosing the juicy sweet mawkish flesh light purple on the exterior, lighter toward the interior, and quite white in the centre; **seed** narrowed at the ends, ½′ long, covered with a thin light brown coat closely invested with a white glutinous aril-like pulpy mass.

A tree, 25°–30° high, with a tall straight trunk sometimes a foot in diameter, upright branches forming a compact oblong head, and slender slightly zigzag branchlets coated when they first appear with ferrugineous tomentum, becoming in their second year light

Fig. 728

red-brown or ashy gray and covered with small pale elevated circular lenticels; in sandy soil under the shade of Pine-trees in the Everglade Keys a shrub 6° high or less. **Bark** of the trunk ¼′ thick, light brown slightly tinged with red, and broken by shallow fissures into large irregularly shaped plates separating on the surface into small thin scales. **Wood** very heavy, hard, strong, close-grained, light brown shaded with red, with thin lighter colored sapwood.

Distribution. Florida, rich hummocks, from Mosquito Inlet on the east coast to the Everglade Keys, Dade County and to the southern keys, and on the west coast from the shores of the Caloosahatchee River to the neighborhood of Cape Sable; local and nowhere common; on the Bahama Islands, and in Cuba, Porto Rico and Jamaica.

5. MIMUSOPS L.

Trees or rarely shrubs, with stout terete branchlets, small naked buds, and sweet juice. Leaves usually clustered at the end of the branches, with slender inconspicuous transverse veins and minute reticulate veinlets, persistent. Flowers on clavate pedicels from the axils of minute deciduous bracts; calyx 6–8-parted, the divisions in 2 series, those of the exterior series almost valvate in the bud; corolla white, barely longer than the calyx, subrotate, usually dilated at the throat, 6–8-lobed, the lobes furnished at base with a pair of petal-like appendages; stamens as many as the lobes of the corolla; filaments short, dilated; anthers lanceolate, their connectives excurrent, acute, or sometimes aristate at apex; staminodia as many as the lobes of the corolla, scale-like or petaloid, entire, 2-lobed or laciniate; ovary ovoid, hirsute or puberulous, gradually narrowed into a slender style stigmatic at apex. Fruit globose, 1 or 2-seeded, tipped with the much thickened elongated style; skin crustaceous, indurate; flesh thick and dry. Seed oblong-ovoid, slightly compressed; seed-coat crustaceous, chestnut-brown and lustrous; hilum elongated, lateral or minute, basilar; embryo surrounded by thick fleshy albumen; cotyledons flat, thick and fleshy, much longer than the short erect radicle.

Mimusops with thirty or forty species is widely distributed through the tropics of the two hemispheres, a single species reaching the shores of southern Florida. Several species produce hard heavy timber, edible fruits, or valuable milky juices.

The significance of the generic name, from μιμώ and ὄψις in allusion to the shape of the corolla, is not apparent.

1. Mimusops emarginata Britt. Wild Dilly.

Mimusops Sieberi Chap., not A. DC.

Leaves clustered at the end of the branches, involute in the bud oblong-elliptic, or occasionally slightly obovate, rounded or retuse at apex, rounded or cuneate at base, with slightly thickened revolute margins, bright red when they unfold, and slightly puberulous on the under surface of the midrib, and at maturity thick and coriaceous, bright green and

Fig. 729

lustrous, covered on the upper surface with a slight glaucous bloom, conspicuously reticulate-venulose, 3′–4′ long and 1′–1½′ wide, with a stout midrib glabrous, or puberulous with rusty hairs below, and deeply impressed above; appearing in Florida in April and May and deciduous during their second year; petioles slender, grooved, rusty-pubescent, especially while young, ½′–1′ in length. **Flowers** opening in the spring on slender pedicels near the

end of the branches, coated with rusty tomentum and 1′ or more long, from the axils of leaves of the year or from those of fallen leaves of the previous year; calyx narrow-ovoid, divided nearly to the base into 6 lobes, those of the outer row lanceolate, acute, covered on the outer surface with rusty brown tomentum and on the inner surface with pale pubescence, thickened and usually marked at the base on the outer surface by black spots, those of the inner row ovate, acute, keeled toward the base, light greenish yellow and pale-pubescent; corolla light yellow tinged with green, $\frac{2}{3}$′ in diameter, with 6 spreading lanceolate acute divisions entire or erosely toothed toward the apex, their appendage slender, acute and from one half to two thirds their length; staminodia minute, nearly triangular, entire; ovary narrow-ovoid, dark red, puberulous toward the base with pale hairs, and gradually narrowed into an elongated exserted style stigmatic at apex. **Fruit** ripening at the end of a year, in the spring or in early autumn, on a stout erect stem about 1′ long, and persistent until after the tree flowers the following year, subglobose to slightly obovoid, flattened and compressed at apex, 1′–$1\frac{1}{2}$′ in diameter, usually 1-seeded by abortion, with a thick dry outer coat roughened by minute rusty brown scales, and thick spongy flesh filled with milky juice; **seed** $\frac{1}{2}$′ long, with an elongated lateral hilum.

A tree, in Florida rarely more than 30° high, with a short gnarled trunk 12′–15′ in diameter and usually hollow and defective, thick branches forming a compact round head, and stout branchlets clustered at the end of the branches of the previous year, coated when they first appear with dark rufous pubescence, becoming glabrous and light orange-brown at the end of a few weeks, and in their second year covered with thick ashy gray or light red-brown scaly bark and marked by elevated obcordate leaf-scars displaying 3 large dark conspicuous fibro-vascular bundle-scars. **Winter-buds** ovoid, acute, rusty-tomentose. **Bark** of the trunk about $\frac{1}{4}$′ thick and irregularly divided by deep fissures into ridges rounded on the back and broken into small nearly square plates. **Wood** very heavy, hard, strong, close-grained, rich very dark brown, with light-colored sapwood.

Distribution. Florida, only on the southern keys; not common; on the Bahama Islands and in Cuba.

LVII. EBENACEÆ.

Trees or shrubs, with watery juice, and alternate simple entire leaves, without stipules. Flowers diœcious or polygamous, regular, axillary, articulate with the bibracteolate pedicels; calyx persistent; corolla hypogynous, regular; disk 0; stamens more numerous than the lobes of the corolla, inserted on its base, fewer and rudimentary or 0 in the pistillate flower; filaments short; anthers introrse, 2-celled; ovary several-celled; ovules 2 in each cell, suspended from its apex, anatropous; raphe dorsal; micropyle superior. Fruit a 1 or several-seeded berry. Seeds with copious albumen; embryo axile.

The Ebony family with seven genera and a large number of species is widely distributed in tropical and temperate regions, with two representatives of its most important genus, Diospyros, in the flora of the United States.

1. DIOSPYROS L.

Trees or shrubs, with terete branchlets, without a terminal bud, scaly axillary buds, coriaceous leaves revolute in the bud, and fibrous roots. Flowers mostly diœcious, from the axils of leaves of the year or of the previous year; staminate smaller than the pistillate and usually in short few-flowered bracted cymes; pistillate generally solitary; calyx 4-lobed, the lobes valvate in the bud, accrescent under the fruit; corolla 4-lobed, the lobes sinistrorsely contorted in the bud, more or less contracted in the throat, the lobes spreading or recurved; stamens usually 16, inserted on the bottom of the corolla in two rows and in pairs, those of the outer row rather longer than and opposite those of the inner row; filaments free, slender; anthers oblong, apiculate, the cells opening laterally by longitudinal slits; stamens rudimentary or 0 in the pistillate flower; ovary usually 4-celled, each cell more or less completely divided by the development of a false longitudinal partition from its anterior face, rudimentary or 0 in the staminate flower; styles 4, spreading, 2-lobed at

apex; stigmas 2-parted or lobed; ovule solitary in each of the divisions of the cells. Fruit globose, oblong or conic, 1–10-seeded, surrounded at base by the enlarged persistent calyx. Seeds pendulous, oblong, compressed; seed-coat thick and bony, dark, more or less lustrous; embryo axile, straight or somewhat curved; cotyledons foliaceous, ovate or lanceolate; radicle superior, cylindric, turned toward the small hilum.

Diospyros, which is chiefly tropical, is widely distributed with more than two hundred species in the two hemispheres, with a few species extending beyond the tropics into eastern North America, eastern Asia, southwestern Asia, and the Mediterranean region.

Diospyros produces hard close-grained valuable wood, with dark or black heartwood and thick soft yellow sapwood. The ebony of commerce is partly produced by different tropical species. The fruit is often edible, and some of the species are important fruit-trees in China and Japan.

The generic name, from Διός and πυρός, is in allusion to the life-giving properties of the fruit.

CONSPECTUS OF THE SPECIES OF THE UNITED STATES.

Flowers on branchlets of the year; anthers opening longitudinally nearly throughout their entire length; filaments pubescent; pistillate flowers with 8 rudimentary stamens; ovary nearly glabrous; leaves oval; fruit green, yellow, orange color or rarely black. **1. D. virginiana** (A, C).

Flowers on branchlets of the previous year; anthers opening only near the apex; filaments glabrous; pistillate flowers without rudimentary stamens; ovary pubescent; leaves cuneate-oblong or obovate; fruit black. **2. D. texana** (C).

1. Diospyros virginiana L. Persimmon.

Leaves ovate-oblong to oval or elliptic, acuminate or abruptly acuminate at apex, narrowed and cuneate or rounded or rarely broad and rounded at base, coriaceous, glabrous, dark green and lustrous on the upper surface, pale on the lower surface, 4′–6′ long and 2′–3′

Fig. 730

wide, with a broad flat midrib, about six pairs of conspicuous primary veins arcuate near the margins and reticulate veinlets; falling in the autumn usually without much change of color; petioles stout, glabrous or slightly villose-pubescent, ½′–1′ in length. **Flowers** appearing when the leaves are more than half grown on branchlets of the year, from March in the extreme south to June in the north; the staminate in 2–3-flowered pubescent pedunculate cymes, on pedicels from the axils of minute lanceolate acute caducous bracts and fur-

nished near the middle with two minute caducous bractlets; the pistillate solitary, on short recurved pedicels, bibracteolate with conspicuous acute bractlets ciliate on the margins and often $\frac{1}{4}'$ in length; corolla of the staminate flower tubular, $\frac{1}{2}'$ long, slightly contracted below the short acute reflexed lobes forming before expansion a pointed 4-angled bud rather longer than the broad-ovate acute foliaceous ciliate calyx-lobes inflexed on the margins; stamens with short slightly hairy filaments and linear-lanceolate anthers opening throughout their length; pistillate flower $\frac{3}{4}'$ long, with a greenish yellow or creamy white corolla nearly $\frac{1}{2}'$ broad; stamens 8, inserted in one row below the middle of the corolla, with short filaments and sagittate abortive or sometimes fertile anthers; ovary conic, pilose toward the apex, ultimately 8-celled, and gradually narrowed into the four slender styles hairy at the base. **Fruit** on a short thick stem, ripening at the north late in autumn or earlier southward, often persistent on the branches during the winter, depressed-globose to ovoid or slightly obovoid, rounded or pointed at apex, $\frac{3}{4}'$–$2'$ in diameter, yellow or pale orange color, often with a bright cheek, and covered with a glaucous bloom, turning yellowish brown when partly decayed by freezing, surrounded at base by the spreading calyx $1'$–$1\frac{1}{2}'$ in diameter, with broad ovate pointed lobes recurved on the margins; flesh austere while green, yellowish brown, sweet and luscious when fully ripened by the action of frost, or in some forms remaining hard and green during the winter; **seeds** oblong, rounded on the dorsal edge, nearly straight on the ventral edge, rounded at the ends, much flattened, $\frac{1}{2}'$ long and $\frac{1}{3}'$ wide, with a thick hard pale brown rugose testa, a narrow pale hilum and a slender raphe.

A tree, occasionally 50°–60° high, with a short trunk 16′–20′ in diameter, spreading often pendulous branches forming a broad or narrow round-topped head, and slender slightly zigzag glabrous or rarely puberulous branchlets with a thick pith-cavity, light brown when they first appear, becoming during their first winter light brown or ashy gray and marked by occasional small orange-colored lenticels and by elevated semiorbicular leaf-scars, with deep horizontal lunate depressions; or in the primeval forest, under the most favorable conditions, sometimes 100°–130° high, with a long slender trunk free of branches for 70°–80° and rarely exceeding 2° in diameter; frequently not more than 15° or 20° high and sometimes shrubby in habit. **Winter-buds:** axillary, broad-ovoid, acute, $\frac{1}{8}'$ long, with thick imbricated dark red-brown or purple lustrous scales often persistent at the base of young branchlets during the season. **Bark** of the trunk $\frac{3}{4}'$–$1'$ thick, dark brown tinged with red, or dark gray, and deeply divided into thick square plates broken into thin persistent scales, with heavy strong dark brown sometimes nearly black heartwood often undeveloped until the tree is over one hundred years old; used in turnery, for shoe-lasts, plane-stocks, and preferred for shuttles to other American woods. The fruit contains tannin, to which it owes its astringent qualities, and is eaten in great quantities in the southern states. The inner bark is astringent and bitter.

Distribution. Light sandy well drained soil, or in the Mississippi basin sometimes on the deep rich bottom-lands of river valleys; Lighthouse Point, New Haven, New Haven County, Connecticut, and Long Island, New York, through southern Pennsylvania, southern Ohio, southern Indiana and Illinois, to southeastern Iowa, eastern Kansas, central Oklahoma, and southward to De Soto County, Florida, southern Alabama, Mississippi, Louisiana, and Texas to the valley of the Colorado River (Burnett County); very common in the south Atlantic and Gulf states, often covering with shrubby growth by means of the stoloniferous roots abandoned fields and springing up by the side of roads and fences; ascending on the Appalachian Mountains to altitudes of 3500°; rare toward the western limits of its range in Texas. In southeastern Illinois, Missouri and Arkansas passing into the var. *platycarpa* Sarg. with larger broad-ovate leaves rounded or cordate at base or rarely elliptic, more or less densely pubescent on the lower surface, especially on the midrib and petiole, often $2\frac{1}{2}'$–$4'$ long and $2'$–$2\frac{1}{2}'$ wide, and at the end of vigorous shoots up to $6'$ in length, and depressed-globose, yellow, rarely nearly black (f. *atra* Sarg.), fruit much depressed at top and bottom, $1\frac{3}{4}'$–$3'$ wide and about $1'$ high, with sweet succulent flesh, ripening in September or early October, and seeds conspicuously rounded on the dorsal edge, much compressed, dark chestnut-brown and lustrous, only slightly rugose, $\frac{3}{4}'$ long and $\frac{1}{2}'$

wide. A tree usually not more than 12°–25° high, with a trunk 16′–30′ in diameter and rather stouter branchlets densely villose-pubescent sometimes for two or three years, or becoming glabrate at the end of their first season. Hills near Allenton, St. Louis County, and on the western slopes of the Ozark Mountains and the adjacent prairies of southeastern Missouri and prairies of northwestern Arkansas, eastern Kansas and Oklahoma. In Dade County, Florida, *Diospyros virginiana* is replaced by the var. *Mosieri* Sarg. with smaller staminate flowers, nearly globose fruit with rather less compressed dark chestnut-brown lustrous only slightly rugose seeds. A small tree with slightly fissured light gray bark.

Several named varieties of *Diospyros virginiana* are distinguished and cultivated by pomologists.

2. Diospyros texana Scheele. Black Persimmon. Chapote.

Leaves oblong-cuneate to obovate, rounded and often retuse at apex and cuneate at base, covered below when they unfold with thick pale tomentum and above with scattered long white hairs, and at maturity thick and coriaceous, dark green and lustrous,

Fig. 731

glabrous or puberulous on the upper surface, paler and pubescent on the lower surface, ¾′–1½′ long and nearly 1′ wide, with a broad midrib and about 4 pairs of arcuate primary veins and reticulate veinlets; unfolding in February and March, and falling during the following winter without change of color; petioles short, thick, and hairy. **Flowers** appearing in early spring when the leaves are about one third grown, on branches of the previous year; staminate on slender drooping pedicels furnished near the middle with minute caducous bractlets, in 1–3-flowered crowded pubescent fascicles; pistillate on stouter club-shaped pedicels, solitary or rarely in pairs; calyx of the staminate flower ⅛′ long and deeply divided into 5 ovate or lanceolate silky-tomentose lobes recurved after the opening of the flower, and much shorter than the corolla ⅜′ long, creamy white, and slightly contracted below the 5 short spreading rounded lobes ciliate on the margins; stamens, with glabrous filaments shorter than the corolla, and linear-lanceolate anthers opening at apex only by short slits; pistillate flowers without rudimentary stamens, ⅓′ long, with oblong acute silky-tomentose calyx-lobes half the length of the pubescent corolla nearly ½′ across the short spreading lobes; ovary ovoid, pubescent like the young fruit, ultimately 8-celled. **Fruit** ripening in August, subglobose, ½′–1′ in diameter, and 3–8-seeded, surrounded at base by the large thickened leathery calyx sometimes 1′ in diameter, with oblong pubescent reflexed lobes, the thick tough black skin inclosing thin sweet insipid juicy dark flesh; **seeds** triangular, rounded on the back, narrowed and flattened at the pointed apex, ⅓′ long, about ⅛′ thick, with a bony lustrous light red pitted coat.

An intricately branched tree, occasionally 40°–50° high, with a trunk 18′–20′ in diameter, dividing at some distance above the ground into a number of stout upright branches forming a narrow round-topped head, and slender terete slightly zigzag branchlets, coated at first with pale or rufous tomentum, ashy gray, glabrous or puberulous during their first winter, later becoming brown and marked by minute pale lenticels and by small elevated semiorbicular leaf-scars displaying a lunate row of fibro-vascular bundle-scars; often much smaller, and toward the northern and western limits of its range a low many-stemmed shrub. **Winter-buds** obtuse, barely more than $\frac{1}{16}$′ long, with broad-ovate scales rounded on the back and coated with rufous tomentum. **Bark** of the trunk smooth, light gray slightly tinged with red, the outer layer falling away in large irregularly shaped patches displaying the smooth gray inner bark. **Wood** heavy, with black heartwood often streaked with yellow and clear bright yellow sapwood; used in turnery and for the handles of tools. The fruit, which is exceedingly austere until it is fully ripe, stains black, and is sometimes used by Mexicans in the valley of the Rio Grande to dye sheepskins.

Distribution. Southwestern Texas, Matagorda County (neighborhood of Matagorda and Bay City) to the lower Rio Grande, and northward to Brown County; in Coahuila, Nuevo Leon, and Tamaulipas; possibly in southern Lower California; abundant in southwestern Texas; in the neighborhood of the coast on the borders of prairies in rich moist soil; westward on dry rocky mesas and in isolated cañons; very common and of its largest size in the region between the Sierra Madre and the coast of the Gulf of Mexico in Nuevo Leon and Tamaulipas.

LVIII. STYRACACEÆ.

Trees or shrubs, with stellate pubescence or lepidote, watery juice, and scaly buds. Leaves alternate, simple, penniveined, without stipules. Flowers regular, perfect; calyx more or less adnate to the tube of the corolla; disk 0; anthers introrse, 2-celled, the cells opening longitudinally; ovary superior or partly superior, crowned with a simple style; ovules anatropous. Fruit drupaceous, with thin dry flesh, and a thick-walled 1-seeded bony stone. Seeds, with albumen.

The Storax family is confined to North and South America, the Mediterranean region, eastern Asia and the Malay Archipelago. Of the six genera of this family two are represented in the flora of North America.

CONSPECTUS OF THE GENERA OF THE UNITED STATES.

Calyx adherent to the whole surface of the ovary; corolla 4-lobed. Fruit oblong-obovoid, 2 or 4-celled and 2 or 4-winged. **1. Halesia.**

Calyx adherent to the base only of the ovary; corolla usually 5-parted. Fruit subglobose, 1-celled. **2. Styrax.**

1. HALESIA L. SILVER BELL TREE.

Trees or shrubs, with stellate pubescence, slender terete pithy branchlets, without a terminal bud, axillary buds with imbricated accrescent scales, and fibrous roots. Leaves involute in the bud, thin, elliptic, oblong-ovate or oblong-ovoid, denticulate, deciduous. Flowers opening in early spring, on slender elongated drooping ebracteolate pedicels from the axils of foliaceous acuminate or acute caducous bracts, in fascicles or short racemes from the axils of leaves of the previous year; calyx-tube obconic, adherent to the whole surface of the ovary, the limb short, 4-toothed, with minute triangular teeth, open in the bud; corolla epigynous, campanulate, 4-lobed, or divided nearly to the base, the lobes convolute or imbricated in the bud, thin and white or rarely tinged with rose; stamens 8–16; filaments elongated, shorter than the corolla, slightly attached at base, or sometimes free, flattened below; anthers oblong, adnate or free at the very base; ovary 2 or 4-celled, gradually contracted into an elongate glabrous or tomentose style stigmatic at apex; ovules 4 in each cell, attached by elongated funiculi at the middle of the axis, the 2 upper ascending,

the 2 lower pendulous; raphe dorsal; micropyle inferior and superior. Fruit ripening in the autumn, elongated, oblong or obovoid and gradually narrowed at base; skin tough, separable, light green and lustrous, turning reddish brown late in the autumn; exocarp indehiscent, thick, becoming dry and corky at maturity, produced into 2 or 4 broad thin wings cuneate at base and rounded at apex; stone bony, cylindric, obovoid or ellipsoid, gradually narrowed at base into a slender stipe inclosed in the wings, narrowed above and terminating in the enlarged style protruding above the wings, usually obscurely and irregularly 8-angled or sulcate, 1–4-celled. Seed solitary in each cell, elongated, cylindric; seed-coat thin, light brown, lustrous, adherent to the walls of the stone, the delicate inner coat attached to the copious fleshy albumen; embryo terete, axile, erect; cotyledons oblong, as long as the elongated radicle turned toward the minute hilum.

Halesia inhabits the southeastern United States and eastern China.

The generic name is in honor of Stephen Hales (1677–1761), an English clergyman, author of "Vegetable Staticks."

CONSPECTUS OF THE SPECIES OF THE UNITED STATES.

Fruit 4-winged; flowers fascicled; corolla slightly lobed.
- Fruit oblong to slightly obovoid.
  - Flowers hardly more than $\frac{1}{2}'$ long; fruit $1\frac{1}{2}'$ in length. — **1. H. carolina** (A, C).
  - Flowers 2′ long; fruit up to 2′ in length. — **2. H. monticola** (A).
- Fruit clavate; flowers usually not more than $\frac{1}{4}'$ long. — **3. H. parviflora** (C).

Fruit 2-winged; flowers often racemose; corolla divided nearly to the base. — **4. H. diptera** (C).

1. Halesia carolina L.

Mohrodendron carolinum Britt.

Leaves elliptic to oblong-obovate, abruptly acuminate and long-pointed at apex, gradually narrowed and rounded or cuneate at base, and dentate with small remote callous teeth, slightly pubescent or covered below when they unfold with thick hoary tomentum and

Fig. 732

densely stellate-pubescent above (var. *mollis* Perkins), and at maturity dark yellow-green and glabrous on the upper surface, pale and glabrous or slightly villose below on the slender yellow midrib and primary veins, 3′–4′ long and $1\frac{1}{2}'$–2′ wide, and on leading shoots up to 6′–7′ in length; turning yellow in the autumn before falling; petioles slender, glabrous, pubescent or tomentose, early in the season, becoming nearly glabrous, $\frac{1}{4}'$–$\frac{1}{2}'$ in length.

Flowers about $\frac{1}{2}'$ long, on glabrous or densely or slightly villose pedicels $\frac{1}{2}'$–$\frac{3}{4}'$ in length, from the axils of ovate caducous serrate glabrous or pubescent bracts rounded at apex, in crowded fascicles; calyx obconic, glabrous, slightly pubescent or hoary-tomentose (var. *mollis* Lange), the lobes ciliate; corolla narrowed below into a short tube, $\frac{3}{4}'$ across, sometimes faintly tinged with rose, rarely divided nearly to the base (var. *dialypetala* Schn.); stamens 10–16; filaments villose with occasional white hairs; ovary 4-celled. **Fruit** oblong to oblong-obovate, 4-winged, $1\frac{1}{2}'$ long, $\frac{1}{2}'$–$\frac{3}{4}'$ in diameter; stone ellipsoid to slightly obovoid, narrowed below into a short stipe and above into the slender apex terminating in the elongated persistent style, slightly angled, $\frac{1}{2}'$–$\frac{5}{8}'$ long, usually 1-seeded by abortion; **seed** rounded at the narrow ends, $\frac{1}{4}'$–$\frac{1}{3}'$ long.

A round-headed tree, rarely 40° high, with a short trunk often divided near the ground into several spreading stems, and 12′–18′ in diameter, small branches, and slender branchlets glabrous or densely pubescent early in the season, becoming slightly pubescent or nearly glabrous and orange-brown, and marked by large obcordate leaf-scars during their first winter and dark red-brown the following year; more often a shrub with wide-spreading stems. **Winter-buds** ellipsoid to ovoid, $\frac{1}{8}'$ long, with thick broad-ovate dark red acute puberulous scales rounded on the back, those of the inner rows becoming strap-shaped, bright yellow and sometimes $\frac{1}{2}'$ long. **Bark** of the trunk $\frac{1}{2}'$ thick, slightly ridged, reddish brown, separating into thin closely appressed scales. **Wood** light, soft, close-grained, light brown with thick lighter-colored sapwood.

Distribution. Wooded slopes and the banks of streams, southern West Virginia (Fayette and Summers Counties); Piedmont region of North and South Carolina, ascending to altitudes of 2000′, through central Georgia to western Florida, and through Alabama south to Dallas County to western Kentucky and southern Illinois (near Metropolis, Massac County); the var. *mollis* with the type and the more common form in western Florida southward to Suwanee County. A seedling shrubby Halesia (var. *Meehanii* Perkins) with thicker smaller darker green rugose leaves, smaller cup-shaped flowers on shorter pedicels, appeared many years ago in the Meehan Nurseries at Germantown, Pennsylvania, and is possibly a hybrid but of obscure origin.

Often cultivated in the eastern United States, in California and in western and central Europe; hardy as far north as eastern Massachusetts.

2. Halesia monticola Sarg.

Leaves elliptic to oblong-obovate, abruptly acuminate at apex, cuneate or occasionally rounded at base, remotely dentate with minute blunt teeth, covered above when they unfold with short white hairs and below with thick hoary tomentum, half-grown and pubescent on the midrib below when the flowers open at the end of May, and at maturity thin, dark dull green on the upper surface, pale on the lower surface, glabrous with the exception of a few hairs on the lower side of the slender midrib and primary veins, 8′–11′ long and $1\frac{1}{2}'$–$2\frac{1}{2}'$ wide; turning yellow in the autumn before falling; petioles slender, villose-pubescent when they first appear, soon glabrous, $\frac{1}{2}'$–$\frac{3}{4}'$ in length. **Flowers** 2′ long on pedicels $\frac{1}{2}'$–1′ in length, from the axils of obovate or elliptic acute pubescent bracts $\frac{1}{2}'$–$\frac{3}{4}'$ long and $\frac{1}{4}'$ wide; calyx obconic, glabrous or slightly villose-pubescent; corolla 1′ in diameter, contracted below into a short limb; stamens 10–16; filaments slightly villose toward the base, ovary 4-celled. **Fruit** oblong-obovoid, cuneate at base, 4-winged, $1\frac{3}{4}'$–2′ long, 1′ in diameter; stone ovoid-ellipsoid, abruptly narrowed below into a short stipe, gradually narrowed above into the long apex, prominently angled about $1\frac{1}{2}'$–$1\frac{3}{4}'$ in length.

A tree, often 80°–90° high, with a trunk 3° in diameter and free of branches for 50°–60°, comparatively small spreading and erect branches forming a round-topped head and slender branchlets covered when they first appear with pale hairs, soon glabrous, lustrous, light red-brown or orange-brown during their first winter and dark red-brown in their second year. **Winter-buds** ovoid to ellipsoid, acuminate, much compressed, gibbous on the back, the outer scales thick, slightly keeled on the back, lustrous, bright red, $\frac{1}{3}'$ long. **Bark** of the trunk thick, separating freely into long broad loosely attached red-brown plates $\frac{1}{2}'$–$\frac{3}{4}'$ thick.

Distribution. Mountain slopes at altitudes from 3000°–4000°, western North Carolina, eastern Tennessee and western Georgia; passing into the var. *vestita* Sarg., with

Fig. 733

leaves often rounded at base, coated below and on the petioles when they unfold with snow-white tomentum, and at maturity pubescent over the lower surface, especially on the midrib and veins, and occasionally pale rose-colored flowers (f. *rosea* Sarg.); banks of streams, near Marion, McDowell County, North Carolina, to Arkansas and eastern Oklahoma; occasionally cultivated with the var. *vestita* and hardy in the Arnold Arboretum and in Rochester, New York.

Halesia monticola in cultivation grows rapidly with a single trunk; and is hardy in eastern Massachusetts.

3 Halesia parviflora Michx.

Leaves oblong-ovate to slightly obovate or elliptic, abruptly long-pointed or acuminate at apex, narrowed and cuneate or rounded at base, finely serrate with minute glandular

Fig. 734

teeth, densely covered when they unfold with hoary tomentum, becoming pubescent or glabrous, $2\frac{1}{2}'$–$3\frac{1}{4}'$ long and $1'$–$1\frac{1}{4}'$ wide, with a slender midrib and primary veins villose-

pubescent below; petioles hoary-tomentose when they first appear, becoming glabrous, $\frac{1}{4}'$–$\frac{1}{3}'$ in length. **Flowers** opening the end of March or early in April, $\frac{1}{4}'$–$\frac{1}{3}'$ long, on pedicels more or less densely villose-pubescent with white hairs, becoming nearly glabrous, $\frac{1}{3}'$–$\frac{2}{3}'$ in length; calyx densely hoary-tomentose or rarely villose-pubescent; corolla $\frac{1}{3}'$–$\frac{1}{2}'$ in diameter; stamens 10–16, filaments slightly villose. **Fruit** ripening in August and September, clavate, gradually narrowed into the long stipitate base, $\frac{3}{4}'$–$1\frac{1}{2}'$ long, 4-winged, the wings narrow, of equal width or occasionally with the alternate wings narrower than the others; stone ovoid, abruptly narrowed below into a short stipe, gradually narrowed to the apex, obscurely angled, $\frac{3}{4}'$–$1\frac{1}{4}'$ long.

A slender tree, 25°–30° high, with a long trunk 8′–10′ in diameter, small light brown slightly ridged branches and slender branchlets hoary-tomentose when they first appear, becoming pubescent or nearly glabrous by the end of their first season and light gray-brown in their second year; or a shrub only a few feet tall. **Winter-buds** ovoid, acute, slightly compressed, villose, about $\frac{1}{8}'$ long. **Bark** of the trunk thick, dark brown or nearly black, and divided by deep longitudinal furrows into narrow rounded rough ridges.

Distribution. Northern Florida, in sandy uplands (St. John, Clay, Jackson, Gadsden and Lafayette Counties); not common; Alabama (Lee County); eastern Mississippi (Laurel, Jones County), and eastern Oklahoma (near Page, Le Flore County).

4. Halesia diptera Ellis.

Mohrodendron dipterum Britt.

Leaves ovate to obovate, oval or elliptic, abruptly long-pointed or rarely rounded at apex, gradually narrowed and cuneate or rounded at base, undulate-serrate with remote minute callous teeth, coated below with pale tomentum and pubescent above when they unfold, and at maturity thin, light green and glabrous or pubescent on the slender midrib on the upper surface and paler and soft-pubescent on the lower surface, 3′–4′ long and 2′–$2\frac{1}{2}'$ wide, and at the end of vigorous branches up to 8′ long and 3′ wide, with pale con-

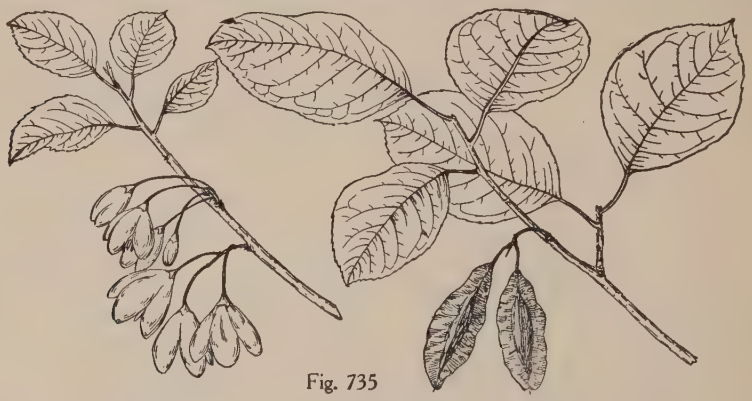

Fig. 735

spicuous arcuate veins and reticulate veinlets; petioles slender, pubescent, $\frac{1}{2}'$–$\frac{3}{4}'$ in length. **Flowers** opening from the middle of March to the end of April, usually nearly 1′ long, on slender tomentose pedicels $1\frac{1}{2}'$–2′ in length, from the axils of obovate puberulous bracts rounded or acute at apex and $\frac{1}{2}'$–$\frac{3}{4}'$ long, in few-flowered fascicles or in 4–6-flowered racemes; calyx thickly covered with hoary tomentum, the short lobes nearly glabrous on the inner surface; corolla puberulous on the outer surface, divided nearly to the base into slightly obovate or oval spreading lobes; stamens 8–16, usually 8, nearly as long as the corolla; filaments covered with pale hairs, and sometimes free from the corolla; ovary usually 2, rarely 4-celled and covered, like the style, with pale pubescence. **Fruit** oblong to

slightly obovoid, compressed, 1½′–2′ long, often nearly 1′ wide, with two broad wings and often with 2 or rarely 3 narrow wings between them; stone ellipsoid, 1½′–1¾′ long, conspicuously ridged, gradually narrowed below into the short slender stipe and above into the thickened pubescent style; seed acuminate at the ends, about ¾′ in length.

A tree, occasionally 30° high, with a short or rarely a tall trunk 8′–10′ in diameter, spreading branches forming a wide head and slender branchlets light green and more or less thickly covered with pale pubescence when they first appear, usually becoming glabrous, orange color, or reddish brown, lustrous and marked by the large elevated obcordate leaf-scars during their first winter, dark red-brown in their second season and dividing the following year into irregular pale longitudinal fissures; more often a shrub, with numerous stout spreading stems. **Winter-buds** ovoid, obtuse, $\frac{1}{16}$′ long, with broad-ovate acute light red pubescent scales, those of the inner ranks becoming strap-shaped, scarious and ¼′ long **Bark** of the trunk ⅓′–½′ thick, brown tinged with red, and divided by irregular longitudinal often broad fissures, and separating into small thin closely appressed scales **Wood** light, soft, strong, close-grained, light brown with thick lighter-colored sapwood.

Distribution. Low wet woods and the borders of swamps and streams; near Savannah (*Elliott*) and in southwestern Georgia, middle Florida (Leon and Gadsden Counties), southern Alabama, Mississippi and Louisiana to the valley of the lower Neches River, Texas.

Occasionally cultivated in the gardens of the eastern United States and western Europe. Doubtfully hardy in Massachusetts and western New York.

2. STYRAX L.

Trees or shrubs, lepidote or stellate-tomentose except on the upper surface of the leaves, with slender terete slightly zigzag branchlets, without a terminal bud, axillary buds, with imbricated scales, and fibrous roots Leaves involute in the bud, entire or slightly serrate. Flowers usually white on short ebracteolate drooping pedicels from the axils of small bracts, in simple or branched usually drooping axillary racemes; calyx cup-shaped, adnate to the base of the ovary or nearly free, the margin truncate, obscurely or conspicuously 5-toothed or rarely 2 or 5-parted; corolla epigynous, campanulate, 5 or rarely 6 or 7-parted, with a short tube usually longer than the lanceolate oblong or spatulate erect and spreading or revolute lobes valvate or imbricated in the bud, stamens 8–13, usually 10, longer than the corolla slightly united below into a ring or short tube; filaments flattened above; cells of the anthers linear parallel, erect; ovary broad-conic, subglobose or depressed, densely villose or rarely glabrous, at first 3-celled, becoming 1-celled or nearly 1-celled after anthesis, crowned by a subulate or thickened style terminating in a small indistinctly 3-lobed or capitate stigma; ovules few or rarely solitary ascending; raphe dorsal, micropyle inferior Fruit globose or slightly obovoid, drupaceous; pericarp hard and indehiscent or irregularly 3-valved or fleshy and irregularly dehiscent; endocarp glabrous, crustaceous or indurate; seed 1 by abortion or very rarely 2, filling the cavity of the stone, erect; testa membranaceous, mostly adherent to the walls of the stone; albumen fleshy or rarely horny; cotyledons usually broad, the elongated terete radicle turned toward the broad basal hilum.

Styrax is widely distributed in warm and tropical countries except in tropical and south Africa and in Australasia, extending northward into the southeastern United States and to California, southern Europe, central and western China and central Japan. Of nearly one hundred species which are now distinguished five are found within the territory of the United States; one of these occasionally becomes a small tree.

Storax and benzoin, aromatic resinous balsams, are obtained from *Styrax officinale* L. of southern Europe and Asia Minor, and from *Styrax Benzoin* Dryand. of Malaysia.

The generic name is that of the Greek name of *Styrax officinale.*

1. Styrax grandifolia Ait.

Leaves thin, deciduous, obovate, rounded and abruptly pointed or acute or acuminate or rarely rounded at apex, cuneate or rounded at the narrow base, entire or remotely serrate

with small apiculate teeth, when they unfold ciliate on the margins, slightly stellate-pubescent on the midrib and veins above, and coated below with hoary tomentum, and at maturity pale green and glabrous or nearly glabrous above, pale tomentose and villose on the

Fig. 736

midrib and veins below, $2\frac{1}{2}'$–$5'$ long and $1'$–$3'$ wide; petioles $\frac{1}{4}'$ in length, hoary-tomentose early in the season, becoming pubescent. **Flowers** opening in early spring after the leaves are more than half grown, $\frac{3}{4}'$–$1'$ long, on slender pubescent or tomentose pedicels $\frac{1}{4}'$ in length, in tomentose leafy erect or spreading axillary racemes $5'$ or $6'$ long, their bracts and bractlets linear, minute, tomentose, caducous; calyx more or less coarsely 5-toothed, membranaceous, tomentose on the outer surface; corolla 5-parted, the lobes longer than the tube, imbricated in the bud, membranaceous, oblong-obovate, rounded or acute at apex, stellate-pubescent on the outer surface; stamens 10, about as long as the corolla, villose-pubescent below the middle, united below into a short ring; ovary slightly inferior, obovoid, tomentose, 3-celled; style filiform, glabrous, exserted; ovules 3 or 4 in each cell. **Fruit** hoary-tomentose, slightly obovoid, rounded and tipped at apex with the remnants of the style, gradually narrowed and surrounded below by the calyx, $\frac{1}{3}'$ long, and $\frac{1}{4}'$ in diameter, the outer coat crustaceous, indehiscent; **seed** obovoid, dark orange-brown, filling the cavity of the fruit.

A tree, rarely 40° high, with a tall straight trunk sometimes $8'$ in diameter, short spreading branches forming a narrow round-topped head, and slender branchlets thickly coated when they first appear with hoary stellate pubescence more or less persistent during three seasons, ultimately glabrous and light or dark chestnut-brown; more often a broad shrub 6°–20° high. **Bark** of the trunk $\frac{1}{3}'$–$\frac{1}{2}'$ thick, close, smooth and dark red-brown. **Winter-buds: axillary,** often 3, superposed, acute, covered with hoary ultimately rusty tomentum, about $\frac{1}{8}'$ long.

Distribution. Low wet woods and the borders of swamps; southeastern Virginia, southward usually near the coast to the valley of the Apalachicola River, Florida, and through the Gulf states to western Louisiana, ranging inland to northern Georgia, northeastern Mississippi, and to the valley of the Red River at Natchitoches, Louisiana; of its largest size and perhaps only arborescent near Laurel Hill, West Feliciana Parish, Louisiana.

LIX. SYMPLOCACEÆ.

Trees or shrubs, with simple pubescence, watery juice, scaly buds, and fibrous roots. Leaves simple, alternate, coriaceous or thin, pinnately veined, usually becoming yellow

in drying, without stipules. Flowers regular, perfect, or polygamo-dicœcious, on ebracteolate pedicels, in dense or lax axillary spikes or racemes, with small caducous bracts; calyx campanulate, 5-lobed, open in the bud, the tube adnate to the ovary, enlarged after anthesis; corolla divided nearly to the base into 3–11 usually 5 lobes imbricated in the bud; disk 0; stamens usually numerous, inserted in many series on the base of the corolla or rarely 4 in one series; filaments filiform or flattened, more or less united below into clusters; anthers ovoid-globose, introrse, 2-celled, the cells lateral, opening longitudinally; ovary inferior or partly inferior, 2–5-celled, contracted into a simple style, with an entire or slightly lobed terminal stigma; ovules 2 or rarely 4 in each cell, suspended from its inner angle, anatropous; raphe ventral; micropyle superior. Fruit a drupe (in the North American species), crowned with the persistent lobes of the calyx, with thin dry flesh and a bony 1-seeded stone. Seed oblong, suspended; seed-coat membranaceous; embryo terete, erect in copious fleshy albumen; cotyledons much shorter than the long slender radicle turned toward the broad conspicuous hilum.

The family consists of the genus Symplocos.

1. SYMPLOCOS L'Her.

Characters of the family.

Symplocos with nearly three hundred species inhabits chiefly the warmer parts of America, Asia, and Australia, one species occurring in the southern United States.

Symplocos contains a yellow coloring matter, and the bark and leaves of some species have medical properties.

The generic name, from Σύμπλοκος, relates to the union of the filaments of some of the species.

1. Symplocos tinctoria L'Her. Sweet Leaf. Horse Sugar.

Leaves revolute in the bud, oblong, acute or acuminate at apex, gradually narrowed at base, obscurely crenulate-serrate with remote teeth, or sometimes nearly entire, coated below when they unfold with pale tomentum, glabrous or tomentose above, and furnished on the margins with minute dark caducous glands, and at maturity subcoriaceous, dark

Fig. 737

green and lustrous on the upper surface, paler and pubescent on the lower surface, 5′–6′ long and 1′–2′ wide, with a broad midrib rounded and sometimes puberulous on the upper side, inconspicuous arcuate veins and reticulate veinlets; northward and at high altitudes falling in the autumn, and southward remaining on the branches until after the opening of

the flowers the following spring; petioles stout, slightly winged, $\frac{1}{3}'$–$\frac{1}{2}'$ in length. **Flowers;** flower-clusters inclosed in the bud by ovate acute orange-colored scales brown and ciliate on the margins, each of the flower-buds surrounded by 3 imbricated oblong bracts rounded or pointed at apex and ciliate on the margins, the longest as long as the calyx and one third longer than the 2 lateral bracts; flowers fragrant, opening from the 1st of March at the south to the middle of May on the southern Appalachian Mountains, on short pedicels enlarged into thick hemispheric receptacles covered with long white hairs, in nearly sessile many-flowered clusters in the axils of leaves of the previous year; calyx oblong, cup-shaped, dark green and puberulous, with minute ovate scarious lobes rounded at apex; corolla creamy white, $\frac{1}{4}'$ long, with rounded lobes; stamens exserted, with slender filaments united at base into 5 clusters, and orange-colored anthers; ovary 3-celled, furnished on the top with 5 dark nectariferous glands placed opposite the lobes of the calyx, and abruptly contracted into a slender style gradually thickened toward the apex and longer than the corolla. **Fruit** ripening in the summer or early autumn, ovoid, $\frac{1}{4}'$ long, dark orange-colored or brown; **seed** ovoid, pointed, with a thin papery chestnut-brown coat.

A tree, occasionally 30°–35° high, with a short trunk barely exceeding 6′–8′ in diameter, slender upright branches forming an open head, and stout terete pithy branchlets light green and coated with pale or rufous tomentum when they first appear, or sometimes glabrous, and covered with scattered white hairs, reddish brown to ashy gray, tinged with red and usually more or less pubescent or often covered with a glaucous bloom during their first and second years, later growing darker, roughened by occasional small elevated lenticels and marked by the low horizontal obcordate leaf-scars displaying a central cluster of large fibro-vascular bundle-scars; or more often a shrub. **Winter-buds** ovoid, acute, covered with broad-ovate nearly triangular acute scales, those of the inner rows accrescent on the young branchlets, and at maturity oblong-obovate, rounded and often apiculate at apex, light green, glabrous or pilose, ciliate on the margins, and often $\frac{1}{2}'$ in length. **Bark** of the trunk $\frac{1}{3}'$–$\frac{1}{2}'$ thick, ashy gray slightly tinged with red, divided by occasional narrow fissures and roughened by wart-like excrescences. **Wood** light, soft, close-grained, light red or brown, with thick lighter colored often nearly white sapwood of 18–20 layers of annual growth. The leaves are sweet to the taste and are devoured in the autumn by cattle and horses, and, like the bark, yield a yellow dye occasionally used domestically. The bitter aromatic roots have been used as a tonic.

Distribution. Moist rich soil, often in the shade of dense forests; peninsula of Delaware to northern Florida and from the coast to altitudes of nearly 4000° on the Blue Ridge in North and South Carolina, and to eastern Texas and southern Arkansas; in the Gulf states in hammocks and bluffs.

LX. OLEACEÆ.

Trees or shrubs, with watery juice, scaly buds, their inner scales accrescent, opposite leaves, without stipules, and fibrous roots. Flowers perfect, dicœcious or polygamous, regular; calyx 4-lobed, or 0; corolla of 2–4 petals, or 0; disk 0; stamens 2–4, rudimentary or 0 in unisexual pistillate flowers; anthers attached on the back below the middle, often apiculate by the prolongation of the connective, introrse, 2-celled, the cells opening longitudinally usually by lateral slits; ovary free, 2 or rarely 3-celled, rudimentary or 0 in the staminate flower; style simple; ovules 2 in each cell, pendulous, anatropous; micropyle superior. Fruit (in the North American arborescent genera) a samara or berry. Seed pendulous; seed-coat membranaceous; embryo straight in copious fleshy albumen; cotyledons flat, much longer than the short terete superior radicle turned toward the minute hilum.

The Olive family with twenty-five genera is widely distributed in temperate and tropical regions chiefly in the northern hemisphere. Of the five genera indigenous to the United States four are arborescent. To this family belong *Olea europæa* L., the Olive-tree of the Mediterranean basin, now largely cultivated in California for its fruit, and the Lilacs, Forsythias, Privets, and Jasmines, favorite garden plants in all countries with temperate climates.

CONSPECTUS OF THE ARBORESCENT GENERA OF THE UNITED STATES.

Fruit a winged samara; leaves usually compound. 1. Fraxinus.
Fruit a drupe; leaves simple.
Flowers usually without petals. 2. Forestiera.
Flowers with petals.
Corolla of 4 long linear petals united only at base; leaves deciduous. 3. Chionanthus.
Corolla tubular; leaves persistent. 4. Osmanthus.

1. FRAXINUS L. Ash.

Trees or shrubs, with thick furrowed or rarely thin and scaly bark, usually ash-colored branchlets, with thick pith, and compressed obtuse terminal buds much larger than the lateral buds. Leaves petiolate, unequally pinnate or rarely reduced to a single leaflet, deciduous; leaflets conduplicate in the bud, usually serrate, petiolulate or sessile. Flowers dicœcious or polygamous, produced in early spring on slender elongated pedicels, without bractlets, in open or compact slender-branched panicles, with obovate linear or lanceolate caducous bracts, terminal on leafy shoots of the year, developed from the axils of new leaves, or from separate buds in the axils of leaves of the previous year, or at the base of young branchlets, and covered by 2 ovate scales; calyx campanulate, deciduous or persistent under the fruit, or 0; corolla 2–4-parted, the divisions conduplicate in the bud, united at base, or 0; stamens usually 2, rarely 3 or 4, inserted on the base of the corolla, or hypogynous; filaments terete, short or rarely elongated; anthers ovoid or linear-oblong, the cells opening by lateral slits; ovary 2 or rarely 3-celled, contracted into a short or elongated style terminating in a 2-lobed stigma; ovules suspended in pairs from the inner angle of the cell; raphe dorsal. Fruit a 1 or rarely 2 or 3-seeded winged samara; body terete or slightly flattened contrary to the septum, with a dry or woody pericarp produced into an elongated more or less decurrent wing, usually 1-celled by abortion or sometimes 2 or 3-celled and winged. Seed solitary in each cell, oblong, compressed, gradually narrowed and rounded at the ends, filling the cavity of the fruit; seed-coat chestnut-brown.

Fraxinus with thirty to forty species is widely distributed in the temperate regions of the northern hemisphere, and within the tropics occurs on the islands of Cuba and Java. Of the eighteen North American species here recognized all, with the exception of *Fraxinus dipetala* Hook., of California, are large or small trees.

Fraxinus produces tough straight-grained valuable wood, and some of the species are large and important timber-trees. The waxy exudations from the trunk and leaves of *Fraxinus Ornus* L., of southern Europe and Asia Minor furnish the manna of commerce used in medicine as a gentle laxative; and the Chinese white wax is obtained from the branches of *Fraxinus chinensis* Roxb.

Fraxinus is the classical name of the Ash-tree.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT SPECIES.

Flowers with a corolla, in terminal panicles on lateral leafy branchlets of the year; leaflets 3–7, lanceolate to ovate-lanceolate (Ornus). 1. F. cuspidata (E, H).
Flowers without a corolla, dicœcious or polygamous, in axillary panicles, from separate buds, in the axils of leaves of the previous year (Fraxinastrum).
Flowers with a calyx.
Leaflets with obscure veins, not more than $\frac{3}{4}'$ long; fruit narrow-spatulate to oblong-obovate; rachis slightly winged. 2. F. Greggii (E).
Leaflets with distinct veins, more than $\frac{3}{4}'$ long; rachis without a wing.
Body of the fruit compressed, its wing extending to the base.
Branchlets 4-sided.
Leaves usually 5-foliolate, with ovate acute leaflets; flowers unknown. 3. F. Lowellii (F).

Leaves usually reduced to a single ovate or orbicular leaflet; flowers polygamous. 4. **F. anomala** (F).

Branchlets terete.

Leaflets 5–7, oblong-ovate; fruit oblong-elliptic to spatulate, often 3-winged, long-stipitate. 5. **F. caroliniana** (A, C).

Leaflets 3–5, oblong; fruit lanceolate to oblanceolate, the body extending to the base of the fruit. 6. **F. pauciflora** (C).

Body of the fruit nearly terete.

Wing of the fruit terminal or slightly decurrent on the body.

Leaves and branchlets glabrous (*tomentose in one form of* 7).

Leaflets sessile or nearly sessile 5–7 rarely 5, ovate to oblong-ovate, rarely elliptic, acute or short-acuminate, glaucescent below. 7. **F. Standleyi** (H).

Leaflets stalked.

Leaflets 5–7, ovate to lanceolate, abruptly pointed or acuminate, usually pale below. 8. **F. americana** (A, C)

Leaflets usually 5, ovate to obovate, rounded or acute at apex. 9. **F. texensis** (C).

Leaves and branches pubescent; leaflets oblong-ovate to lanceolate, pale below; fruit linear-oblong. 10. **F. biltmoreana** (A, C).

Wing of the fruit decurrent to below the middle of the body.

Leaflets 7–9, usually 7; leaves and branches pubescent (*glabrous in one form of 12*).

Fruit 2′–3′ in length. 11. **F. profunda** (A, C).

Fruit 1′–2½′ in length. 12. **F. pennsylvanica** (A, E).

Leaflets 3–5.

Leaves and branchlets glabrous; fruit up to 1½′ in length. 13. **F. Berlandieriana** (C, E).

Leaves and branchlets pubescent or glabrous; fruit not more than ½′ in length. 14. **F. velutina** (F, H).

Leaflets 5–7, usually 7, the lateral generally sessile; leaves and branchlets pilose-pubescent, rarely glabrous. 15. **F. oregona** (B, G).

Flowers without a calyx; leaflets 5–11; wing of the fruit decurrent to the base of the body.

Branchlets quadrangular; lateral leaflets short-stalked. 16. **F. quadrangulata** (A, C).

Branchlets terete; lateral leaflets sessile. 17. **F. nigra** (A, C).

1. Fraxinus cuspidata Torr.

Leaves 5′–7′ long, with a slender pale petiole sometimes slightly wing-margined, and 3–7 lanceolate or ovate-lanceolate long-stalked leaflets gradually narrowed at apex into a long slender point, cuneate at base, nearly entire or coarsely and remotely serrate above the middle with recurved teeth (var. *serrata* Rehd.), or with 3–5, rarely 7-foliolate leaves, with broader often ovate entire leaflets occasionally with simple leaves at the base of the branchlets (var. *macropetala* Rehd.); slightly puberulous when they unfold on the lower surface, and at maturity thin, dark green above, paler below, 1½′–2½′ long and ¼′–¾′ wide, with a pale midrib and obscure veins; petiolules slender, sometimes nearly 1′ in length. **Flowers** perfect, extremely fragrant, appearing in April, in open glabrous panicles 3′–4′ long and broad, terminal on lateral leafy branchlets developed from the axils of leaves of the previous year, calyx cup-shaped, $\frac{1}{16}$′ long, with acute apiculate attenuate teeth of unequal length, deciduous, corolla ⅔′ long, thin and white, divided to below the middle into 4 linear-oblong lobes pointed at apex, and much longer than the nearly sessile oblong long-pointed anthers, ovary 2-celled, with a thick 2-lobed nearly sessile stigma. **Fruit** elliptic to oblong-obovate, 1′ long and ¼′ wide, the wing round and slightly emarginate at apex, and decurrent nearly to the base of the flat nerveless longer body.

A tree, rarely 20° high, with a short trunk 6′–8′ in diameter, and slender terete branchlets light red-brown when they first appear, soon becoming darker and marked by scattered

pale lenticels, and ashy gray and roughened by the dark elevated lunate leaf-scars in their second year; more often a shrub or small shrubby tree, with numerous slender spreading

Fig. 738

stems 6°–8° tall. **Winter-buds:** terminal acute, nearly ½′ long, with dark reddish brown glutinous scales.

Distribution. Rocky slopes and dry ridges; western Texas, valley of the Rio Grande (mouth of Devil's River, Valverde County) to the Chisos Mountains, and in southern New Mexico; in Coahuila, Nuevo Leon and Chihuahua; the var. *macropetala* in cañons of northern Arizona; the var. *serrata* (fig. 738) in Coahuila.

2. Fraxinus Greggii A. Gray.

Leaves 1½′–3′ long, with a winged petiole and rachis, and 3–7 narrow spatulate to oblong-obovate leaflets entire or crenately serrate above the middle with remote teeth, a slender

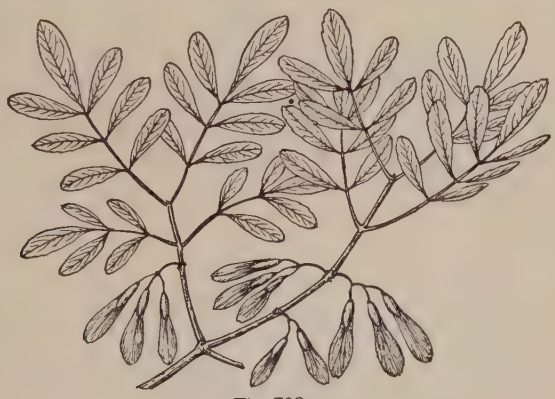

Fig. 739

midrib, and obscure reticulate veins, thick and coriaceous, dark green on the upper surface rather paler and covered with small black dots on the lower surface, ½′–¾′ long, ⅛′–¼′ wide, and nearly sessile. **Flowers** perfect or unisexual, on slender pedicels ⅛′–¼′ long, from the

axils of ovate acuminate rusty-pubescent bracts, in pubescent panicles $\frac{1}{2}'$–$\frac{3}{4}'$ in length; calyx campanulate, scarious; stamens 1 or 2, filaments longer than the calyx, anthers declinate, nearly $\frac{1}{8}'$ long; ovary broad-ovate, rounded at apex, longer than the calyx, the short style terminating in large reflexed stigmatic lobes. **Fruit** narrow-spathulate to oblong-obovate, $\frac{1}{2}'$–$\frac{2}{3}'$ long and about $\frac{1}{4}'$ wide, the thin wing decurrent on the short terete body, rounded and emarginate at apex and tipped with the elongated persistent conspicuous style.

A tree, rarely 20°–25° high, with a trunk 8°–10° long and occasionally 8′ in diameter, and slender terete branchlets dark green and puberulous when they first appear, soon becoming ashy gray and roughened by numerous minute pale elevated lenticels, gradually turning dark gray, or brown in their second and third years; more often a shrub, with numerous slender erect stems 4°–12° tall. **Winter-buds:** terminal, about $\frac{1}{8}'$ long, obtuse, with thick ovate light brown pubescent scales rounded on the back. **Bark** of the trunk thin, gray or light brown tinged with red, separating on the surface into large papery scales. **Wood** heavy, hard, close-grained, brown, with thick lighter-colored sapwood.

Distribution. Western Texas, along rocky beds of streams and deep ravines, Valverde County (near Devil's River, Del Rio and Comstock); on the mountains of northeastern Mexico; apparently most common and of its largest size on the Sierra Nevada of Nuevo Leon.

3. Fraxinus Lowellii Sarg.

Leaves $3\frac{1}{2}'$–$6'$ long, with a stout glabrous or slightly villose petiole, and 5 or rarely 3 ovate stalked leaflets, acuminate and long-pointed, acute or rarely rounded at apex, cuneate at base, serrate, often only above the middle, with small remote teeth, yellow-green, glabrous,

Fig. 740

or puberulous along the midrib above, glabrous or rarely sparingly villose near the base of the slender pale midrib below, $2\frac{1}{4}'$–$3'$ long and $1'$–$1\frac{1}{2}'$ wide, with thin primary veins arching and united near the slightly thickened and revolute margins; on vigorous shoots occasionally 1-foliolate with a broad-ovate or semi-orbicular leaflet. **Flowers** unknown. **Fruit** ripening in July, in long glabrous panicles, oblong-obovate to oblong-elliptic, surrounded at base by the minute slightly dentate calyx, $1'$–$1\frac{1}{2}'$ long, $\frac{1}{4}'$–$\frac{1}{3}'$ wide, the wing broad or gradually narrowed and rounded, and often emarginate at apex and extending to the base of the thin compressed many-rayed body about three-quarters the length of the fruit.

A tree, 20°–25° high, with dark deeply furrowed bark, stout quadrangular often winged branchlets orange-brown in their first season and dark gray-brown the following year.

Distribution. Arizona, rocky slopes of Oak Creek Cañon about twenty miles south of Flagstaff, Coconino County, and in Copper Cañon, west of Camp Verde, Yavapai County.

4. Fraxinus anomala S. Wats.

Leaves mostly reduced to a single leaflet but occasionally 2 or 3-foliolate, the leaflets broad-ovate or orbicular, rounded or acute or rarely obcordate at apex, cuneate or cordate at base, and entire, or sparingly crenately serrate above the middle, covered above when they unfold with short pale hairs and pubescent beneath, and at maturity thin but rather coriaceous, dark green above, paler below, 1½′–2′ long and 1′–2′ wide, or when more than one much smaller, with a broad rather conspicuous midrib and obscure veins, and when solitary raised on a stout grooved petiole rusty-pubescent early in the season, becoming

Fig. 741

glabrous, and often 1½′ long, or short-petiolulate in the compound leaves. **Flowers** appearing when the leaves are about two thirds grown, in short compact pubescent panicles, with strap-shaped or lanceolate acute bracts ½′ long and covered with thick brown villose tomentum, perfect or unisexual by the abortion of the stamens, the 2 forms occurring in the same panicle; calyx cup-shaped, minutely 4-toothed; anthers linear-oblong, orange colored, raised on slender filaments nearly as long as the stout columnar style. **Fruit** obovate, ½′ long, the wing rounded and often deeply emarginate at apex, surrounding the short flattened striately nerved body, and ⅓′ wide.

A tree, 18°–20° high, with a short trunk 6′–7′ in diameter, stout contorted branches forming a round-topped head, and branchlets at first quadrangular, dark green tinged with red and covered with pale pubescence, orange colored and puberulous in their first winter and marked by elevated pale lenticels and narrow lunate leaf-scars, and in their second or third year terete and ashy gray; often a low shrub, with numerous spreading stems. **Winter-buds:** terminal broad-ovoid, acuminate or obtuse, covered with thick orange-colored tomentum, and ⅛′–¼′ long. **Bark** of the trunk dark brown slightly tinged with red, ¼′ thick and divided by shallow fissures into narrow ridges separating into small thin appressed scales. **Wood** heavy, hard, close-grained, light brown, with thick lighter colored sapwood of 30–50 layers of annual growth.

Distribution. In the neighborhood of streams; valley of the McElmo River, southwestern Colorado; Carriso Mountains, San Juan County, northwestern New Mexico; northeastern (Apache County), and the Grand Cañon of the Colorado River, Coconino County, Arizona; southern Utah to the Charleston Mountains, southwestern Nevada and adjacent California (Inyo County).

5. Fraxinus caroliniana Mill. Water Ash. Swamp Ash.

Leaves 7′–12′ long, with an elongated stout terete pale petiole, and 5–7 long-stalked ovate to oblong acute or acuminate leaflets rarely rounded at apex, cuneate or sometimes rounded or subcordate at base, and coarsely serrate with acute incurved teeth, or entire, pilose above and more or less hoary-tomentose below when they unfold, and at maturity thick and firm, 3′–6′ long and 2′–3′ wide, dark green above, paler or sometimes yellow-green and glabrous or pubescent (var. *Rehderiana* Sarg.) beneath, particularly along the conspicuous midrib and the numerous arcuate veins connected by obscure reticulate veinlets. **Flowers** dicœcious, appearing in February and March in short or ultimately elongated panicles inclosed in the bud by chestnut-brown pubescent scales; staminate flower with a minute or nearly obsolete calyx, and 2 or sometimes 4 stamens, with slender filaments and linear apiculate anthers; calyx of the pistillate flower cup-shaped, deeply divided and laciniate, as long as the ovary gradually narrowed into an elongated slender style. **Fruit** elliptic to oblong-obovate, frequently 3-winged, surrounded at base by the persistent calyx, 2′ long, $\frac{1}{3}$′–$\frac{3}{4}$′ wide, often marked on the 2 faces by a conspicuous impressed midvein, the body short, compressed, and surrounded by the broad thin many-nerved sometimes bright violet-colored wing, acute or acuminate, or rounded and emarginate at apex and usually narrowed below into a stalk-like base.

A tree, rarely more than 40° high, with a trunk sometimes 12′ in diameter, small branches forming a narrow often round-topped head, and slender terete branchlets light green and glabrous or tomentose when they first appear, light brown tinged with red and sometimes covered with a glaucous bloom or rarely pubescent or tomentose (var. *Rehderiana* Sarg.) in their first winter, becoming in their second year light gray or yellow, occasionally marked

Fig. 742

by large pale lenticels, and by the elevated semiorbicular leaf-scars displaying a short row of conspicuous fibro-vascular bundle-scars. **Winter-buds:** terminal, $\frac{1}{8}$′ long, with 3 pairs of ovate acute chestnut-brown puberulous scales, those of the outer rank thickened at base, rounded on the back, and shorter than the others. **Bark** of the trunk $\frac{1}{16}$′–$\frac{1}{8}$′ thick, light gray, more or less marked by large irregularly shaped round patches, and separating on the surface into small thin closely appressed scales. **Wood** light, soft, weak, close-grained, nearly white sometimes tinged with yellow, with thick lighter colored sapwood.

Distribution. Deep river swamps inundated during several months of the year, usually under the shade of larger trees, or rarely in drier ground; coast region of the Atlantic and Gulf states, valley of the Potomac River, Virginia, near Washington, D.C., to Florida southward to Lake County and on the west coast to the valley of the lower Apalachicola

River, and to the valley of the Neches River (Beaumont, Jefferson County), Texas, and northward through western Louisiana to southwestern (Malvern, Hot Springs County) Arkansas; east of the Mississippi River occasionally appearing in isolated stations remote from the coast (Anson County, North Carolina, *C. L. Boynton*, Pike County, Georgia, *R. M. Harper*, Forrest County, Mississippi, *T. G. Harbison*); in Cuba.

6. Fraxinus pauciflora Nutt. Water Ash.

Fraxinus floridana Sarg.

Leaves 5′–9′ long, with an elongated stout terete petiole, and 3–7, usually 5, elliptic to oblong-obovate or ovate leaflets, acuminate or rarely abruptly pointed at apex, gradually narrowed and rounded at the often unsymmetric base, finely or coarsely serrate, scurfy-pubescent above and hoary-tomentose below when they unfold, and at maturity thick and

Fig. 743

firm, dark green and glabrous or puberulous on the upper surface and more or less tomentose on the lower surface, 3′–4′ long and 1′–1¼′ wide, with a slender midrib, and thin primary veins arcuate and united within the thickened revolute margins; petiolules of the lateral leaflets ¼′–½′ long, much shorter than those of the terminal leaflet. **Flowers** dicœcious, appearing late in February or early in March, in elongated panicles inclosed in the bud by chestnut-brown pubescent scales; staminate flower composed of an annular disk and 2 or 3 stamens, with short filaments and apiculate anthers; calyx of the pistillate flower cup-shaped, slightly lobed, as long as the ovary gradually narrowed into the slender style. **Fruit** oblong to lanceolate or oblanceolate, surrounded at base by the persistent calyx, 1′–2′ long, ¼′–½′ wide, marked on each of the 2 faces by a broad impressed midvein, the body near the base of the many-nerved wing narrowed, rounded, and emarginate at apex.

A tree, 30°–40° high, with a trunk sometimes 12′ in diameter, small spreading branches, and slender terete branchlets light orange-brown and occasionally marked by large pale lenticels during their first season, ashy gray and roughened the following year by the large horizontal obcordate elevated leaf-scars displaying a central ring of fibro-vascular bundle-scars. **Winter-buds** terminal, broad-ovoid, acute, rusty-pubescent, about ¼′ long. **Bark** of the trunk $\frac{1}{16}$′–⅛′ thick, light gray, and broken on the surface into small thin closely appressed scales.

Distribution. Deep swamps; valleys of the St. Mary's and Flint Rivers (Albany), southern Georgia; Florida, near Jacksonville, Duval County, valley of the Caloosahatchee River, and Bonita Springs, Lee County, to the shores of Lake Okeechobee, and in the valley of the lower Apalachicola River; most abundant in Florida.

7. Fraxinus Standleyi Rehd.

Leaves 5′–7′ long, with a slender glabrous petiole flattened, or slightly concave on the upper side, and 7–9 ovate to oblong-ovate rarely elliptic leaflets, acute or short-acuminate or rarely rounded at apex, broad-cuneate at base, slightly and irregularly ser-

Fig. 744

rate, yellow-green and glabrous above, glaucescent, slightly reticulate, minutely punctulate, glabrous or slightly villose on the slender midrib below, or rarely closely villose over the entire lower surface, $1\frac{1}{2}'$–$2\frac{1}{2}'$ long and 1′–2′ wide, with usually 5–7 primary veins, the terminal leaflet raised on a petiolule up to $\frac{1}{2}'$ long, the lateral short-petiolulate, or nearly sessile. **Flowers** not seen. **Fruit** ripening in September, on slender pedicels, in glabrous panicles 3′–5′ long, oblong-obovate, acute, rarely obtuse and occasionally emarginate at apex, surrounded at base by the minute calyx deeply divided into acuminate lobes, $\frac{3}{4}'$–$1\frac{1}{2}'$ long and $\frac{1}{6}'$–$\frac{1}{4}'$ wide, the wing decurrent nearly to the middle of the subterete or slightly compressed ellipsoid or oblong body.

A tree, sometimes 30° high, usually smaller, with a trunk only a few inches in diameter, and slender terete glabrous branches orange-brown or rarely on vigorous shoots dark red-brown and lustrous. **Winter-buds:** terminal ovoid, gradually narrowed and acute at apex, $\frac{1}{3}'$ long.

Distribution. Mountain cañons at altitudes of 5500°–8000°; New Mexico (Lincoln, Grant and Luna Counties); Arizona (Cochise, Pima and Coconino Counties); on the San José Mountains, Sonora, at an altitude of 7200°; passing into var. *lasia* Rehd. with branchlets, lower surface of the 7 leaflets and petioles densely tomentose; in Oak Creek and Sycamore cañons south of Flagstaff, Coconino County, at Fort Apache, Navajo County, on the White Mountains, Graham County, and on the Chiricahua Mountains, Cochise County, Arizona; and near Santa Rita, Grant County, New Mexico. A single plant, possibly a shrub, of the Mexican *Fraxinus papilosa* Ling. differing chiefly from *F. Standleyi* in the glaucous papillose under surface of the leaves, has been seen at an altitude of 6750° on the west sides of the San Luis Mountains, Grant County, New Mexico.

8. Fraxinus americana L. White Ash.

Leaves 8′–12′ long, with a stout grooved petiole, and 5–9, usually 7, ovate to oblanceolate or oval, often falcate abruptly pointed or acuminate leaflets, cuneate or rounded at base, crenulate-serrate or nearly entire, thin but firm, dark green above, pale or light green and glabrous or slightly pubescent below, or rarely thicker, lanceolate, long-acuminate, entire, glabrous and silvery white below (var. *subcoriacea* Sarg.), 3′–5′ long and 1½′–3′ wide, with a broad midrib, and numerous conspicuous veins arcuate near the margins; falling early in the autumn after turning on some individuals deep purple and on others clear bright yellow; petiolules ¼′–½′ or that of the terminal leaflet up to 1′ in length. **Flowers** dicœcious, opening before the leaves late in the spring, in compact ultimately elongated glabrous panicles from buds covered with dark ovate scales rounded at apex and slightly keeled on the back; calyx campanulate, slightly 4-lobed in the staminate flower, and deeply lobed or laciniately cut in the pistillate flower; stamens 2 or occasionally 3, with short stout filaments, and large oblong-ovate apiculate anthers at first nearly black, later becoming

Fig. 745

reddish purple; ovary contracted into a long slender style divided into 2 spreading dark purple stigmatic lobes. **Fruit** rarely deeply tinged with purple (f. *iodocarpa* Fern.), 1′–2½′ long and usually about ¼′ wide, or sometimes not more than ½′ long (var. *microcarpa* A. Gray), in crowded clusters 6′–8′ in length, lanceolate or oblanceolate, surrounded at base by the persistent calyx, the wing pointed or emarginate at apex and terminal or slightly decurrent on the terete body.

A tree, sometimes 120° high, with a tall massive trunk 5°–6° in diameter, stout upright or spreading branches forming in the forest a narrow crown, or with sufficient space a round-topped or pyramidal head, and thick terete branchlets dark green or brown tinged with red and covered with scattered pale caducous hairs when they first appear, soon becoming light orange color or ashy gray and marked by pale lenticels, becoming in their first winter gray or light brown, lustrous, often covered with a glaucous bloom and roughened by the large pale semiorbicular leaf-scars displaying near the margins a line of conspicuous fibro-vascular bundle-scars. **Winter-buds: terminal** broad-ovoid, obtuse, with 4 pairs of scales, those of the outer pair ovate, acute, apiculate, conspicuously keeled on the back, nearly black, slightly puberulous, about one half the length of the scales of the second pair rather shorter than those of the third pair, lengthening with the young shoots, and at maturity oblong-ovate, narrowed and rounded at apex, keeled, ½′ long, and rusty-pubescent, the scales of the inner pair becoming ⅔′ long, ovate, pointed, keeled, sometimes slightly

pinnatifid, green tinged with brown toward the apex, covered with pellucid dots and very lustrous. **Bark** of the trunk 1′–3′ thick, dark brown or gray tinged with red, and deeply divided by narrow fissures into broad flattened ridges separating on the surface into thin appressed scales. **Wood** heavy, hard, strong, close-grained, tough, and brown, with thick lighter colored sapwood; used in large quantities in the manufacture of agricultural implements, for the handles of tools, in carriage-building, for oars and furniture, and in the interior finish of buildings; the most valuable of the American species as a timber-tree.

Distribution. Common in rich rather moist soil on low hills, and in the neighborhood of streams; Nova Scotia, New Brunswick, southern Quebec and Ontario and the southern peninsula of Michigan, and westward and southward to eastern Minnesota, central Iowa, southeastern Nebraska, Missouri and Arkansas, eastern Kansas, and northern Oklahoma to the valley of the Salt Fork of the Arkansas River in Woods County (near Alva, *G. W. Stevens*), and to Florida to Taylor County and the valley of the lower Apalachicola River, and through the Gulf states to the valley of the Trinity River, Texas; of its largest size on the bottom-lands of the basin of the lower Ohio River; southward and west of the Mississippi River less common and of smaller size; on the Appalachian Mountains up to altitudes of 3800°; the var. *crassifolia* at Mt. Victory, Harding County, Ohio, Campbell, Dunklin County, Missouri, and near Texarkana, Bowie County, Texas.

Often planted in the eastern states as a shade and ornamental tree, and occasionally in western and northern Europe.

A form with the wing of the fruit extending nearly to the middle of the body distinguished as *Fraxinus Smallii* Britt. has the appearance of a hybrid between *F. americana* and *F. pennsylvanica* var. *lanceolata;* individuals of this form have been found near McGuire's Mill, on the Yellow River, Guinnett County, Georgia; near Rochester, Monroe County, New York; and near Lake Wingra, Dane County, Wisconsin.

9. Fraxinus texensis Sarg. Mountain Ash.

Leaves 5′–8′ long, with a long slender terete petiole, and 5 or occasionally 7 usually long-stalked ovate broad-oval or obovate leaflets, rounded or acute, or often abruptly pointed at apex, cuneate, rounded or slightly cordate at base, and coarsely crenulate-serrate, chiefly above the middle, light green slightly tinged with red and pilose with occa-

Fig. 746

sional pale caducous hairs when they unfold, and at maturity thick and firm, glabrous, dark green on the upper surface, pale on the lower surface, 1′–3′ long and $\frac{3}{4}$′–2′ wide, and occasionally furnished below with tufts of long white hairs at the base of the broad midrib, and

in the axils of the numerous conspicuous veins forked near the margins and connected by coarse reticulate veinlets; petiolules slender, $\frac{1}{4}'$–$\frac{1}{2}'$ and on the terminal leaflet up to 1′ in length. **Flowers** dicœcious, appearing in March as the leaves begin to unfold, in compact glabrous panicles from the axils of leaves of the previous year, and covered in the bud by ovate rounded orange-colored scales; staminate flower composed of a minute or nearly obsolete 4-lobed calyx and 2 stamens, with short filaments and linear-oblong light purple apiculate anthers; calyx of the female flower deep cup-shaped, and divided to the base into 4 acute lobes; ovary gradually narrowed into a long slender style. **Fruit** in short compact clusters, spatulate to oblong, surrounded at base by the persistent calyx, $\frac{1}{2}'$–1′ long and $\frac{1}{8}'$–$\frac{1}{4}'$ wide, the wing rounded or occasionally emarginate at apex, and terminal on the short terete many-rayed body; very rarely with 3 or 4 wings extending to the base of the fruit.

A tree, rarely 50° high, with a short trunk occasionally 2°–3° in diameter, thick spreading often contorted branches, and stout terete branchlets dark green tinged with red and slightly puberulous when they first appear, becoming light yellow-brown or light orange color during the summer, and in their first winter light brown marked by remote oblong pale lenticels and by large elevated lunate leaf-scars displaying a row of conspicuous fibro-vascular bundle-scars, and dark or reddish brown in their second or third season; usually much smaller. **Winter-buds:** terminal acute, with 3 pairs of scales, those of the first pair broad-ovate, rounded at the apex, dark orange color, pilose toward the base, and rather shorter than the ovate rounded scales of the second pair coated with rufous tomentum and becoming $\frac{1}{2}'$ long or about one half the length of the linear strap-shaped scales of the inner pair truncate or emarginate at the apex and orange color. **Bark** of the trunk $\frac{1}{2}'$–$\frac{3}{4}'$ thick, dark gray and deeply divided by narrow fissures into broad scaly ridges. **Wood** heavy, hard, strong, light brown, with thin lighter colored sapwood; valued as fuel and occasionally used for flooring.

Distribution. Texas, high dry limestone bluffs and ridges, in the neighborhood of Dallas, Dallas County, and Fort Worth, Tarrant County, to the valley of the Colorado River near Austin, Travis County, and over the Edwards Plateau to Bandera, Kerr, Edwards and Palo Pinto Counties.

Hardy in the Arnold Arboretum.

10. Fraxinus biltmoreana Beadl.

Leaves 10′–12′ long, with a stout pubescent or puberulous petiole, and 7–9 oblong-ovate to ovate-lanceolate or oval often falcate entire or obscurely toothed leaflets acuminate at apex, rounded or cuneate and often inequilateral at base, yellow-bronze color and nearly glabrous above, coated beneath, particularly on the midrib and veins, with long white hairs when they unfold, and at maturity 3′–6′ long, $1\frac{1}{4}'$–2′ wide, thick and firm in texture, dark green and slightly lustrous on the upper surface, pale or glaucous and puberulous on the lower surface and villose along the slender yellow midrib, and primary veins arcuate near the slightly thickened and incurved margins; petiolules pubescent, $\frac{1}{4}'$–$\frac{1}{2}'$ or that of the terminal leaflet up to 2′ in length. **Flowers** dicœcious, appearing with the leaves about the 1st of May, in a rather compact pubescent panicle, with scarious caducous bracts and bractlets; staminate flower with a minute cup-shaped very obscurely dentate calyx and nearly sessile oblong acute anthers; calyx of the pistillate flower much larger and deeply lobed; ovary oblong, gradually narrowed into the slender style divided at apex into 2 short stigmatic lobes. **Fruit** linear-oblong, in elongated glabrous or puberulous clusters, $1\frac{1}{2}'$–$1\frac{3}{4}'$ long and about $\frac{1}{4}'$ wide, the wing terminal, only slightly narrowed at the ends, emarginate at apex, and two and a half to three times longer than the short ellipsoid terete many-nerved body.

A tree, 40°–50° high, with a trunk 12′–18′ in diameter, stout ascending or spreading branches forming an open symmetrical head, and stout light or dark gray branchlets soft-pubescent usually during two seasons, much roughened during their first winter and often for two or three years by the large elevated mostly obcordate or sometimes orbicular leaf-scars displaying a marginal line of fibro-vascular bundle-scars. **Winter-buds:** terminal

ovoid, usually broader than long, and covered with bright brown scales, those of the outer pair keeled on the back and apiculate at apex, the others rounded, accrescent, and slightly villose. **Bark** of the trunk rough, dark gray, and slightly furrowed.

Distribution. Banks of streams and on low river benches; western New Jersey (Bordentown, Burlington County); eastern Pennsylvania (Bucks County); near Arlington, Alex-

Fig. 747

andria County, Great Falls, Fairfax County, Woodbridge, Prince William County, and Clifton Forge, Alleghany County, Virginia; near Easton, Monongalia County, West Virginia, and along the Appalachian Mountains up to altitudes of 2200° to northern Georgia; in northern Alabama (St. Bernard, Cullman County), and westward to eastern Kentucky, central Tennessee and through Ohio northward to Erie County; northern Indiana and Illinois (Richland County), to southeastern Missouri (Campbell, Dunklin County).

11. Fraxinus profunda Bush. Pumpkin Ash.

Leaves 9′–18′ long, with a stout tomentose petiole, and usually 7 but occasionally 9 lanceolate or elliptic entire or slightly serrate leaflets acuminate or abruptly long-pointed at apex, rounded, cuneate and often unsymmetric at base, coated below when they unfold with hoary tomentum, and pilose on the upper surface with short pale hairs, particularly on the midrib and veins, and at maturity thick and firm in texture, dark yellow-green and nearly glabrous on the upper surface, soft-pubescent on the lower surface, 5′–10′ long and 1½′–5′ wide, with a stout yellow midrib deeply impressed and puberulous above and numerous slender primary veins; petiolules stout, tomentose early in the season, usually becoming glabrous or nearly glabrous, ¼′–½′ or that of the terminal leaflet up to 2′ in length. **Flowers** dicœcious, in elongated much-branched pubescent panicles, with oblong or oblong-obovate scarious bracts and bractlets; staminate flower with a minute campanulate obscurely 4-toothed calyx, and 2 or 3 stamens, with comparatively long slender filaments and oblong apiculate anthers; pistillate flower with a large deeply lobed calyx accrescent and persistent under the fruit, and an ovary gradually contracted into a slender style. **Fruit** in long drooping many-fruited pubescent clusters, oblong, 2′–3′ in length and often ½′ wide, the wing sometimes falcate, rounded, apiculate, or emarginate at apex, and decurrent to below the middle or nearly to the base of the thick terete many-rayed body.

A tree, occasionally 120° high, with a slender trunk 3° in diameter above the much enlarged and buttressed base, small spreading branches forming a narrow rather open head, and stout branchlets marked by large pale lenticels, coated at first with hoary tomentum, tomentose and pubescent during their first winter and light gray and pilose or glabrous the

following year, and marked by the oblong slightly raised obconic leaf-scars nearly surrounding the lateral buds; usually much smaller. **Winter-buds** terminal, broad-ovate,

Fig. 748

obtuse, light reddish brown, and covered with close pale pubescence. **Bark** of the trunk $\frac{1}{2}'$–$\frac{3}{4}'$ thick, light gray and divided by shallow fissures into broad flat or rounded ridges broken on the surface into thin closely appressed scales.

Distribution. Deep river swamps often inundated during several months of the year; western New York (*H. F. Sartwell*); southern Indiana and Illinois; western Kentucky (Caldwell and McCracken Counties) and Tennessee (Henderson County); southeastern Missouri, eastern Arkansas (Moark and Corning, Clay County, and Varner, Lincoln County); near New Orleans, Louisiana, eastern Mississippi (near Columbus, Lowndes County), and in the valley of the lower Apalachicola River, western Florida.

Occasionally cultivated; hardy in the Arnold Arboretum.

12. Fraxinus pennsylvanica Marsh. Red Ash.

Leaves 10′–12′ long, with a stout slightly grooved pubescent petiole, and 7–9 oblong-lanceolate, ovate-elliptic or slightly obovate leaflets gradually narrowed at apex into a long slender point, unequally cuneate at base, and obscurely serrate, or often entire below the middle, when they unfold coated below and on the petiole with hoary tomentum, and lustrous and puberulous on the upper surface, and at maturity thin and firm, 4′–6′ long, 1′–$1\frac{1}{2}'$ wide, light yellow-green above and pale and covered below with silky pubescence, with a conspicuous midrib and branching veins; in the autumn turning yellow or rusty brown before falling; petiolules thick, grooved, pubescent, $\frac{1}{8}'$–$\frac{1}{4}'$ or that of the terminal leaflet up to 1′ in length. **Flowers** dicœcious, appearing late in spring as the leaves begin to unfold, in a rather compact tomentose panicle, covered in the bud with ovate rusty-tomentose scales; staminate flower with a minute obscurely toothed cup-shaped calyx, and 2 stamens, with short slender filaments and linear-oblong light green anthers tinged with purple; calyx of the pistillate flower cup-shaped, deeply divided, as long as the ovary gradually narrowed into an elongated style divided at apex into 2 green stigmatic lobes. **Fruit** in an open glabrous or pubescent panicle, lanceolate to slightly oblanceolate or oblong-obovate or elliptic, 1′–$2\frac{1}{2}'$ long, $\frac{1}{4}'$–$\frac{1}{3}'$ wide, surrounded at base by the persistent calyx, the thin wing narrowed, rounded and occasionally emarginate or acute or acuminate and often apiculate at apex, decurrent to below the middle or nearly to the gradually tapering base of the slender terete many-rayed body.

A tree, 40°–60° high, with a trunk rarely exceeding 18′–20′ in diameter, stout upright

branches forming a compact irregularly shaped head, and slender terete branchlets more or less coated when they first appear with pale tomentum sometimes persistent until their second or third year or often disappearing during the first summer, ultimately becoming ashy gray or light brown tinged with red, frequently covered with a glaucous bloom and marked by pale lenticels, and in their first winter by the semicircular leaf-scars displaying a short row of large fibro-vascular bundle-scars. **Winter-buds:** terminal, about $\frac{1}{8}'$ long, with 3 pairs of scales coated with rufous tomentum, those of the outer pair acute, rounded on the back, truncate at apex, and rather shorter than those of the other pairs $1'–1\frac{1}{2}'$ long

Fig. 749

at maturity and sometimes pinnately cut toward the apex. **Bark** of the trunk $\frac{1}{2}'–\frac{2}{3}'$ thick, brown tinged with red, and slightly furrowed, the surface of the ridges separating into thin appressed scales. **Wood** heavy, hard, rather strong, brittle, coarse-grained, light brown, with thick lighter brown sapwood streaked with yellow; sometimes confounded commercially with the more valuable wood of the White Ash. Variable in the length of the petiolules and in the shape of the fruit and the width of its wing; a form with short-stalked or nearly sessile leaflets, found chiefly in Nebraska has been described as *F. campestris* Britt. and a form with the wing of the spatulate fruit sometimes $\frac{1}{4}'$ wide as *F. Michauxii* Britt.

Distribution. Low rich moist soil near the banks of streams and lakes; Nova Scotia to Manitoba, and southward to central Georgia, northern Alabama (St. Bernard, Cullman County, and Attalla, Etowah County), northeastern Mississippi (Tishomingo County), southern Indiana and Illinois, northern Missouri, eastern Kansas and southwestern Oklahoma (Cache, Comanche County); usually confined in the Carolinas to the Piedmont region and foothills of the high mountains. Passing into

Fraxinus pennsylvanica var. lanceolata Sarg. Green Ash.

Leaves with rather narrower and shorter and usually more sharply serrate leaflets lustrous and bright green on both surfaces, and glabrous or pubescent along the midrib below.

A round-topped tree, rarely more than 60° high, or with a trunk more than 2° in diameter, slender spreading branches, ashy gray terete glabrous branchlets marked by pale lenticels, and rusty-pubescent bud-scales.

Distribution. Banks of streams; valley of the Penobscot River (Orono, Penobscot County), Maine, to northern Vermont and the valley of the St. Lawrence River, near Montreal, Province of Quebec, and to the valley of the Saskatchewan (Saskatoon, Saskatchewan), and in the United States westward to North Dakota, eastern Wyoming to the base of the Bighorn Mountains, and on the mountains of northern Montana, and south-

ward to western Florida to the valley of the lower Apalachicola River, Dallas County, Alabama, central Mississippi, Louisiana, Oklahoma to Comanche County, and Texas to the valley of the Guadalupe River; most abundant in the basin of the Mississippi River;

Fig. 750

attaining its largest size on the rich bottom-lands of eastern Texas and here often 60°–70° high, with a trunk 2°–3° in diameter; on the southern Appalachian Mountains ascending to altitudes of 2000°–2500°. As it usually grows in the east with its bright green glabrous leaves and glabrous branchlets the Green Ash appears distinct from the Red Ash, but trees occur over the area which it inhabits, but more often westward, with slightly pubescent leaves and branchlets which may be referred as well to one tree as to the other and make it impossible to distinguish satisfactorily as species the Green and Red Ash.

Often planted as a shade and ornamental tree in the middle western and occasionally in the eastern states, but less valuable than the White Ash.

13. Fraxinus Berlandieriana DC.

Leaves 3′–7′ long, with a slender petiole, and 3–5 lanceolate, elliptic or obovate leaflets, acuminate or abruptly acuminate or acute at apex, cuneate or rarely rounded at base,

Fig. 751

mostly entire or remotely serrate, thin, dark green and glabrous on the upper surface, rather paler and glabrous or furnished with small axillary tufts of white hairs on the lower surface, 3′–4′ long and ½′–1½′ wide; petiolules slender, 1¼′–1⅓′ or that of the terminal leaflet up to 1½′ in length. **Flowers** dicœcious, in a short glabrous panicle inclosed in the bud by broad-ovate rounded chestnut-brown pubescent scales; staminate flower with a minute obscurely lobed calyx and 2 stamens, with short filaments and linear-oblong apiculate anthers; calyx of the pistillate flower cup-shaped, deeply divided, and as long as the ovary gradually narrowed into the slender style. **Fruit** ripening in May, oblong-obovate to spatulate, acute or acuminate at apex, 1′–1½′ long and ¼′ wide, the wing decurrent nearly to the base of the compressed many-rayed clavate body gradually narrowed into a long slender base surrounded by the enlarged deeply lobed calyx.

A tree, rarely more than 30° high, or with a trunk more than a foot in diameter, and terete slender branchlets light green when they first appear, becoming in their first winter light brown tinged with red or ashy gray, and marked by occasional lenticels and by the small elevated nearly circular leaf-scars displaying a short row of large fibro-vascular bundle-scars. **Winter-buds:** terminal acute, with dark brown puberulous scales. **Bark** of the trunk dark gray tinged with red, 1′–1½′ thick, and divided by shallow interrupted fissures into narrow ridges. **Wood** light, soft, close-grained, light brown, with thick lighter colored sapwood.

Distribution. Texas, banks of streams and mountain cañons, valley of the Colorado River (Bastrop and Travis Counties), and those of the San Antonio and Nueces Rivers to the lower Rio Grande, and over the Edwards Plateau to Palo Pinto County; in northeastern Mexico.

14. Fraxinus velutina Torr.

Leaves 4′–5′ long, with a broad densely villose petiole grooved like the slender rachis on the upper side, and 3–5 elliptic to ovate or slightly obovate leaflets acute at apex, narrowed and rounded or cuneate at base, finely crenulate-serrate above the middle, pubescent above

Fig. 752

and tomentose below when they unfold, and at maturity thick, pale green, glabrous on the upper surface, tomentose on the lower surface, 1′–1½′ long and ¾′–1′ wide, with a prominent midrib and primary veins, and conspicuous reticulate veinlets; petiolules of the lateral leaflets ⅙′ or less or that of the terminal leaflet up to ½′ in length. **Flowers** dicœcious, appearing in March and April with the unfolding of the leaves, on long slender pedicels, in

elongated pubescent panicles, covered in the bud by broad-ovate tomentose scales rounded at apex; calyx cup-shaped, densely pubescent; stamens, with short slender filaments and oblong apiculate anthers; ovary nearly inclosed in the calyx, shorter than the nearly sessile lobes of the stigma. **Fruit** ripening in September, on slender villose pedicels, in large many-fruited clusters, oblong-obovate to elliptic, surrounded at base by the enlarged deeply divided calyx, rarely more than $\frac{3}{4}'$ long and $\frac{1}{6}'$ wide, the wing terminal, rounded and often emarginate or acute at apex, shorter than the terete many-rayed clavate body attenuate at base and $\frac{5}{12}'$–$\frac{1}{2}'$ in length.

A slender tree, 25°–30°, rarely 40°–50° high, with a trunk 12′–18′ in diameter, stout often spreading branches forming a round-topped head, and slender terete branchlets coated during their first season with hoary tomentum, and ashy gray, glabrous and marked by large obcordate dark leaf-scars in their second year. **Winter-buds:** terminal acute, $\frac{1}{8}'$ long, with 3 pairs of broad-ovate pointed tomentose scales, those of the inner pair strap-shaped and $\frac{1}{2}'$ long when fully grown. **Bark** of the trunk $\frac{1}{3}'$–$\frac{1}{2}'$ thick, gray slightly tinged with red, and deeply divided into broad flat broken ridges separating on the surface into small thin scales. **Wood** heavy, rather soft, not strong, close-grained, light brown, with thick lighter colored sapwood; used locally for axe-handles and in the manufacture of wagons.

Distribution. Mountain cañons up to altitudes of 6000°, central and southern Arizona and southern New Mexico. Passing into the following varieties: var. *coriacea* Rehd. (*Fraxinus coriacea* S. Wats.) differing in its thicker more coriaceous often more coarsely serrate leaflets and in the less densely pubescent or glabrescent branchlets; southern Utah (St. George, Washington County) to southeastern California; var. *glabra* Rehd. with glabrous 3–7-foliolate leaves and glabrous branchlets; common with the species; occasionally cultivated in the cities of Arizona; more distinct is

Fraxinus velutina var. Toumeyi Rehd.

Fraxinus Toumeyi Britt.

Leaves $3\frac{1}{2}'$–$6'$ long, with a villose-pubescent petiole, and 5–7 lanceolate to elliptic or rarely obovate acuminate and long-pointed or acute leaflets, finely serrate above the middle, glabrous on the upper surface, covered on the lower surface with close fine pubescence,

Fig. 753

$1\frac{1}{2}'$–$3'$ long and $\frac{1}{3}'$–$1'$ wide; petiolules slender, pubescent, $\frac{1}{8}'$–$\frac{1}{2}'$ or that of the terminal leaflet up to $1'$ in length; occasionally on vigorous shoots reduced to a single leaflet. **Flowers** as in the species. **Fruit** narrow-oblong, $1'$ long and often not more than $\frac{1}{12}'$ wide, or spatulate

with the wing longer or shorter than the body, and sometimes only about $\frac{3}{4}'$ long and $\frac{1}{16}'$ wide, with the wing longer or not more than half the length of the body.

A tree, usually 20°–30° high, with a trunk 6′–8′ in diameter, and ashy gray branchlets pale pubescent when they first appear, becoming glabrous or puberulous during their second season.

Distribution. Mountain cañons at altitudes of 5000°–6000°; in Arizona more common than *F. velutina;* less abundant in southern New Mexico; in Sonora.

Often used to shade the streets in the towns of southern Arizona.

15. Fraxinus oregona Nutt.

Leaves 5′–14′ long, with a stout grooved and angled pubescent, tomentose or glabrous petiole, and usually 5–7, rarely 3, or on young trees occasionally 9, ovate to elliptic or rarely oval or obovate leaflets usually contracted at apex into a short broad point, gradually nar-

Fig. 754

rowed at base, and entire or remotely and obscurely serrate, usually coated below and on the petioles with thick pale tomentum when they unfold and pubescent above, or nearly glabrous or pilose with a few scattered hairs, and at maturity light green on the upper surface, paler and usually tomentose, puberulous or rarely glabrous (var. *glabra* Rehd.), on the lower surface, 3′–7′ long and 1′–$1\frac{1}{2}'$ wide, with a broad pale midrib, conspicuous veins arcuate near the margins, and reticulate veinlets, the lateral usually sessile, rarely on petiolules up to $\frac{1}{2}'$, or that of the terminal leaflet up to 1′ in length; turning yellow or russet brown in the autumn before falling. **Flowers** dicœcious, appearing in April or May when the leaves begin to unfold, in compact glabrous panicles covered in the bud by broad-ovate scales coated with rufous pubescence; staminate flower composed of a minute calyx, short filaments, and short-oblong apiculate anthers; calyx of the pistillate flower laciniately cut and shorter than the ovary narrowed into a stout style divided into long conspicuous stigmatic lobes. **Fruit** in ample crowded clusters, oblong, obovate to oblanceolate or elliptic, rounded and often emarginate or acute at apex, 1′–2′ long and $\frac{1}{4}'$–$\frac{1}{3}'$ wide, the wing decurrent to the middle or nearly to the attenuate base of the clavate or ellipsoid slightly compressed many-rayed body.

A tree, frequently 70°–80° high, with a long trunk occasionally 4° in diameter, stout branches forming a narrow upright head or a broad shapely crown, and thick terete branchlets more or less densely coated with pale or rarely rufous silky pilose tomentum persistent during their second year or occasionally deciduous during their first summer, becoming light red-brown or orange color, glabrous or puberulous, often covered with a slight glaucous bloom, marked by small remote pale lenticels, and during their first and

second winters by the large elevated semiorbicular leaf-scars displaying a short row of conspicuous fibro-vascular bundle-scars, rarely always glabrous (var. *glabra* Rehd.). **Winter-buds:** terminal acute, $\frac{1}{8}'$–$\frac{1}{4}'$ long, with 4 pairs of scales covered with pale hairs or with rusty pubescence, those of the inner rows often foliaceous at maturity. **Bark** of the trunk 1′–1½′ thick, dark gray, or brown slightly tinged with red, and deeply divided by interrupted fissures into broad flat ridges separating on the surface into thin scales. **Wood** light, hard, brittle, coarse-grained, brown, with thick lighter colored sapwood; largely used in the manufacture of furniture, for the frames of carriages and wagons, in cooperage, the interior finish of houses, and for fuel.

Distribution. Usually in rich moist soil in the neighborhood of streams; coast region of southern British Columbia, southward through western Washington and Oregon and the California coast region to the Bay of San Francisco and the Santa Cruz Mountains, and along the western foothills of the Sierra Nevada to those of the mountains of San Bernardino and San Diego Counties, California; the var. *glabra* in Los Angeles and San Bernardino Counties, and east of the Sierra Nevada in Inyo County (Ash Creek, near Owens Lake), and occasionally northward in California; most abundant and of its largest size on the bottom-lands of the rivers of southwestern Oregon; one of the most valuable of the deciduous-leaved timber-trees of Pacific North America.

Occasionally cultivated; hardy in the Arnold Arboretum.

16. Fraxinus quadrangulata Michx. Blue Ash.

Leaves 8′–12′ long, with a slender petiole glabrous, or puberulous toward the base, and 5–11 oblong-ovate to lanceolate long-pointed coarsely serrate leaflets unequally rounded or cuneate at base, and coated when they unfold on the lower surface with thick brown to-

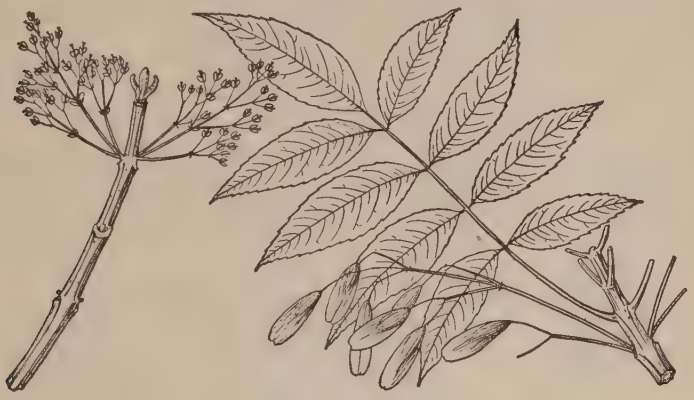

Fig. 755

mentum, and at maturity thick and firm, yellow-green and glabrous above, pale and glabrous or sometimes furnished with tufts of pale hairs along the base of the conspicuous midrib below, 3′–5′ long and 1′–2′ wide, with short stout petiolules and 8–12 pairs of veins arcuate near the margins; turning pale yellow in the autumn before falling. **Flowers** perfect, appearing as the terminal buds begin to expand, in loose-branched panicles from small obtuse buds with scales keeled on the back, apiculate at apex, and covered with thick brown tomentum; calyx reduced to an obscure ring; corolla 0; stamens 2, with nearly sessile broad connectives and dark purple oblong obtuse anther-cells; ovary oblong-ovoid, gradually narrowed into a short style divided at apex into 2 light purple stigmatic lobes generally maturing and withering before the anthers open. **Fruit** oblong to oblong-cuneate, 1′–2′ long

and $\frac{1}{3}'$–$\frac{1}{2}'$ wide, the wing rounded and often emarginate or acute at apex, surrounding the flat body faintly many-rayed on both surfaces.

A tree, usually 60°–70° or occasionally 120° high, with a trunk 2°–3° in diameter, small spreading branches forming a slender head, and stout 4-angled branchlets more or less 4-winged between the nodes, dark orange color and covered with short rufous pubescence when they first appear, becoming gray tinged with red in their second year and marked by scattered pale lenticels and by the large elevated obcordate leaf-scars displaying a lunate row of fibro-vascular bundle-scars, and in their third year light brown or ashy gray and then gradually becoming terete. **Winter-buds:** terminal about $\frac{1}{4}'$ long, with 3 pairs of scales, those of the outer row thick, rounded on the back, usually obscurely pinnate toward the apex, dark reddish brown, slightly puberulous or often hoary-tomentose, partly covering the bud, those of the inner rows strap-shaped, coated with light brown tomentum, often pinnate, becoming $1'$–$1\frac{1}{2}'$ long. **Bark** of the trunk $\frac{1}{2}'$–$\frac{2}{3}'$ thick, irregularly divided into large plate-like scales, the light gray surface slightly tinged with red separating into thin minute scales. **Wood** heavy, hard, close-grained, rather brittle, light yellow streaked with brown, with thick lighter colored sapwood of 80–90 layers of annual growth; largely used for flooring and in carriage-building, and not often distinguished commercially from that of other species of the northern and middle states. A blue dye is obtained by macerating the inner bark in water.

Distribution. Rich limestone hills, occasionally descending into the bottom-lands of fertile valleys; southwestern Ontario through southern Michigan to southwestern Iowa and southward through western Ohio and southeastern Indiana to eastern and central Kentucky (near Clarksville, Montgomery County), eastern Tennessee and northern Alabama (near Huntsville, Madison County), and through Missouri to southeastern Kansas, southwestern Arkansas and northeastern Oklahoma (near Pawhuska, Osage County); nowhere very abundant; of its largest size in the basin of the lower Wabash River, Illinois, and on the western slopes of the Big Smoky Mountains, Tennessee.

Occasionally cultivated as an ornament of parks and gardens in the eastern United States.

17. Fraxinus nigra Marsh. Black Ash. Brown Ash.

Leaves 12′–16′ long, with a stout pale petiole, and 7–11 oblong or oblong-lanceolate long-pointed leaflets, unequally cuneate or sometimes rounded at base, serrate with small incurved apiculate teeth, the lateral sessile, the terminal on a petiolule up to 1′ in length, covered especially below when they unfold with rufous hairs, and at maturity thin and firm,

Fig 756

dark green above, paler below, glabrous with the exception of occasional tufts of rufous hairs along the under side of the broad pale midrib, 4′–5′ long and 1′–2′ wide, with many conspicuous primary veins arcuate near the margins and obscurely reticulate veinlets; turning rusty brown and falling early in the autumn. **Flowers** polygamous, without a perianth, appearing before the leaves in a compact or ultimately elongated panicle 4′–5′ long, and covered in the bud by broad-ovate dark brown or nearly black scales rounded at apex; staminate flowers on separate trees or mixed with perfect flowers, and consisting of 2 large deeply pitted oblong dark purple apiculate anthers attached on the back to short broad filaments; pistillate flower consisting of a long slender style deeply divided into 2 broad purple stigmas and often accompanied by 1 or 2 perfect or globose rudimentary pink anthers sessile or borne on long or short filaments. **Fruit** in open panicles 8′–10′ in length, oblong to slightly oblong-obovate, 1′–1½′ long and ⅓′ wide, with a thin wing, surrounding the short flat faintly nerved body, rounded and emarginate at apex and narrowed and rounded or cuneate at base.

A tree, occasionally 80°–90° high, with a tall trunk rarely exceeding 20′ in diameter, slender mostly upright branches forming a narrow head, and stout terete branchlets dark green and slightly puberulous when they first appear, soon becoming ashy gray or orange color and marked by large pale lenticels, growing darker during their first winter and then roughened by the large suborbicular leaf-scars displaying a semicircular row of conspicuous fibro-vascular bundle-scars; usually much smaller. **Winter-buds:** terminal broad-ovate, acute, rather less than ¼′ long, with 3 pairs of scales, those of the outer pair thick and rounded on the back at base, gradually narrowed and acute at apex, dark brown, slightly puberulous, falling as the bud begins to enlarge in the spring, and shorter than the scales of the inner rows coated on the outer surface with rufous pubescence, those of the second pair becoming strap-shaped, 1′ long, ⅓′ wide, and about half as long as the pinnate usually foliaceous inner scales. **Bark** of the trunk gray slightly tinged with red, ⅓′–½′ thick, and divided into large irregular plates separating into thin papery scales. **Wood** heavy, rather soft, not strong, tough, coarse-grained, durable, easily separable into thin layers, dark brown, with thin light brown often nearly white sapwood; largely used for the interior finish of houses and in cabinet-making, and for fences, barrel hoops, and in the manufacture of baskets.

Distribution. Deep cold swamps and the low banks of streams and lakes; southern Newfoundland and the northern shores of the Gulf of St. Lawrence to Lake Winnipeg, and southward to New Castle County, Delaware, the mountains of West Virginia, southwestern Indiana (Knox County; now probably exterminated by drainage), and central Iowa.

2. FORESTIERA Poir. Swamp Privet.

Adelia Michx.

Trees or shrubs, with thin close bark, slender branchlets, and small scaly buds. Leaves simple, entire or serrulate, petiolate, deciduous or persistent. Flowers dicœcious or polygamous, minute, on slender ebracteolate pedicels, in fascicles or panicles, their bracts caducous, from buds in the axils of leaves of the previous year and covered with numerous scales; calyx reduced to a narrow ring or cup-shaped, 5 or 6-lobed; corolla 0; stamens hypogynous; filaments 2–4; anthers ovoid, opening by lateral slits; ovary 2-celled, gradually narrowed into a slender style terminating in an abruptly enlarged 2-lobed stigma; ovules 2 in each cell, suspended from its apex; raphe dorsal. Fruit 1 or very rarely 2-celled, drupaceous, oblong or subglobose, with thin flesh and a thin-walled stone; seed 1 in each cell, pendulous, testa membranaceous; albumen fleshy; cotyledons plane, nearly filling the cavity of the stone.

Forestiera with 14 species is distributed from the southern United States and Mexico through Central America to Paraguay, and through the West Indies to Brazil.

The generic name is in memory of the French physician and botanist Charles Leforestière.

1. Forestiera acuminata Poir.

Leaves elliptic, acuminate and long-pointed at apex, gradually narrowed and cuneate at base, serrate above the middle with small remote incurved teeth, glabrous with the exception of occasional hairs on the upper side of the slender midrib, yellow-green on the upper surface, paler on the lower surface, $2\frac{1}{2}'$–$4\frac{1}{2}'$ long and $1'$–$1\frac{1}{2}'$ wide, with usually 5 or 6 pairs of slender primary veins and slightly thickened and incurved margins, deciduous; petioles slender, often slightly winged above the middle, $\frac{1}{4}'$–$\frac{1}{2}'$ in length. **Flowers** appearing in April and May before the leaves from ovoid pointed buds $\frac{1}{8}'$ long, with thickened pale chestnut-brown scales; calyx reduced to a narrow slightly lobed ring; corolla 0; staminate in many-flowered fascicles, on short pedicels from the axils of broad-obovate thin yellow apiculate conspicuous bracts; stamens 4, on long slender filaments; anthers bright yellow; ovary reduced to a minute ovoid body; pistillate flowers on slender pedicels $\frac{1}{8}'$ long, in glabrous pedunculate several-flowered panicles $\frac{3}{4}'$–$1\frac{1}{4}'$ long, their bracts caducous; stamens with shorter filaments and abortive or rarely fertile anthers, or usually 0; ovary oblong-ovoid, slightly unsymmetric, gradually narrowed into the long slender style enlarged into the thickened imperfectly 2-lobed terminal stigma. **Fruit** falling as soon as ripe in June and July, oblong-ovoid, gradually narrowed, acute and tipped with the remnants of the style at apex, gradually narrowed and rounded at base, slightly compressed and unsymmetric, dark blue-purple, $1'$–$1\frac{1}{4}'$ long, about $\frac{1}{4}'$ thick, with thin dry flesh, and a striate stone rounded at base, straight on one side and rounded on the other, its wall covered with thin vertical scales spongy in appearance, and conspicuously longitudinally ridged on the inner surface the ridges terminating in long slender tips forming the acuminate apex of the stone; **seeds** ellipsoid, slightly compressed, striate, light brown, about $\frac{1}{3}'$ in length.

Fig. 757

A tree, rarely 50° high, with a short trunk 8′–10′ in diameter, small spreading branches, and slender light brown branchlets becoming darker in their second year, and marked by numerous lenticels and by the small elevated nearly orbicular leaf-scars. **Winter-buds:** terminal ovoid, pointed, about $\frac{1}{10}'$ long, with numerous scales increasing in size from the outer to the inner ranks; usually much smaller, and generally a shrub 10°–15° high and broad. **Bark** close, slightly ridged, dark brown.

Distribution. Borders of streams and swamps in low moist soil; valley of the lower Wabash River, southwestern Indiana, southern Illinois northward along the Mississippi River to Pike County, and to central Tennessee, and from southern Missouri through Arkansas to eastern Oklahoma (near Muskogee, Muskogee County) and eastern Texas to the valley

of the lower Colorado River inland to Colorado County (shores of Eagle Lake), and through Louisiana, central and southern Mississippi and Alabama to western Florida (Branford, Suwanee County) and on the Savannah River, near Augusta, Richmond County, Georgia; most abundant in Missouri, Arkansas and Texas; comparatively rare east of the Mississippi River, but probably of its largest size in eastern Louisiana.

Occasionally cultivated; hardy in the Arnold Arboretum.

3. CHIONANTHUS L.

Trees or shrubs, with stout terete or slightly angled branchlets, thick pith, and buds with numerous opposite scales. Leaves simple, conduplicate in the bud, deciduous. Flowers dicœcious or rarely polygamous, on elongated ebracteolate pedicels, in 3-flowered clusters terminal on the slender opposite branches, of ample loose panicles, with foliaceous persistent bracts, from separate buds in the axils of the upper leaves of the previous year; calyx minute, deeply 4-parted, the divisions imbricated in the bud, persistent under the fruit; corolla white, deeply divided into 4 or rarely 5 or 6 elongated linear lobes conduplicate-valvate in the bud, united at base into a short tube, or rarely separate; stamens 2, inserted on the base of the corolla opposite the axis of the flower, or rarely 4 in the staminate flower, included; filaments terete, short; anthers ovoid, attached on the back below the middle, apiculate by the elongation of the connective, 2-celled, the cells opening by longitudinal lateral or subextrorse slits; ovary ovoid, abruptly contracted into a short columnar style; stigma thick and fleshy, slightly 2-lobed; in the staminate flower of the Asiatic species reduced to a minute subglobose body; ovules laterally attached near the apex of the cell; raphe ventral. Fruit an ovoid or oblong, usually 1 or rarely 2 or 3-seeded thick-skinned drupe tipped with the remnants of the style; flesh thin and dry; stone thick-walled, crustaceous. Seed filling the cavity of the stone, ovoid; seed-coat chestnut-brown.

Chionanthus inhabits the middle and southern United States with one species, and northern and central China with another.

The specific name, from χιών and ἄνθος, is in allusion to the light and graceful clusters of snow-white flowers.

1. Chionanthus virginica L. Fringe-tree. Old Man's Beard.

Leaves ovate or oblong, acuminate, short-pointed or sometimes rounded at apex, gradually narrowed and cuneate below, entire, with undulate margins, and coarsely reticulate-

Fig. 758

venulose, yellow-green and lustrous above, pubescent below, and ciliate on the margins when they unfold, and at maturity 4′–8′ long, ½′–4′ wide, thick and firm, dark green on

the upper surface, pale and glabrous on the lower surface except on the stout midrib and conspicuous arcuate primary veins more or less covered with short white hairs; turning bright clear yellow before falling early in the autumn; petioles stout, puberulous, $\frac{1}{2}'$–$1'$ in length. **Flowers** slightly and agreeably fragrant, appearing when the leaves are about one third grown, in loose pubescent drooping panicles $4'$–$6'$ in length, the bracts at the base of the lower branches of the inflorescence oblong, glabrous on the upper surface, pubescent on the lower surface, and sometimes $1'$ long, those at the base of the upper branches oval, successively smaller, and gradually passing into the minute laciniate bracts subtending the lateral pedicels of the 3-flowered clusters terminating the last divisions of the panicle; some individuals bearing occasional perfect flowers among others functionally dicœcious, some with sterile or rarely perfect anthers and a well-developed stigma, and others with an imperfectly developed stigma and fertile anthers; calyx light green, glabrous, with acute entire or laciniately cut lobes; corolla $1'$ long, marked on the inner surface near the base by a row of bright purple spots; anthers light yellow, with a green connective. **Fruit** ripening in September, in loose few-fruited clusters, their bracts leaf-like and sometimes $2'$ in length, oval or short-oblong, $1'$ long, dark blue or nearly black, and often covered with a glaucous bloom; **seeds** $\frac{1}{3}'$ long, ovoid, narrowed at apex and covered with a thin light chestnut-brown coat marked by reticulate veins radiating from the hilum.

A tree, 20°–30° high, with a short trunk $8'$–$10'$ in diameter, stout ashy gray or light brown branches forming an oblong rather narrow head, and stout branchlets light green and covered with pale pubescence or sometimes glabrous when they first appear, terete or slightly angled in their first winter, often much thickened below the nodes, light brown or orange color, and marked by large scattered darker colored lenticels and by the elevated semiorbicular leaf-scars displaying a semicircular row of conspicuous fibro-vascular bundle-scars; often a shrub, with several stout thick spreading stems. **Winter-buds** broad-ovoid, acute, $\frac{1}{8}'$ long, with about 5 pairs of scales increasing in length from the outer to the inner pair, ovate, acute, keeled on the back, light brown and slightly pilose on the outer surface, bright green and lustrous on the inner surface, and ciliate on the margins with scattered white hairs, those of the inner pair at maturity obovate, gradually narrowed below, foliaceous, and $1'$–$1\frac{1}{2}'$ long. **Bark** of the trunk $\frac{1}{4}'$–$\frac{1}{2}'$ thick, and irregularly divided into small thin appressed brown scales tinged with red. **Wood** heavy, hard, close-grained, and light brown, with thick lighter colored sapwood. The bark is tonic and is sometimes used in decoctions and in the treatment of intermittent fevers, or as an aperient and diuretic, and in homœopathic practice.

Distribution. Banks of streams in rich moist soil; southeastern Pennsylvania to northeastern Kentucky, and to the Manatee River region, western Florida, and through the Gulf states to northern Arkansas (Baxter and Cleburne Counties), southwestern Oklahoma (near Page, Leflore County) and the valley of the Brazos River, Texas; ascending on the southern Appalachian Mountains to altitudes of 4000°.

Often cultivated as an ornamental plant in the eastern United States, and in western and central Europe.

4. OSMANTHUS Lour.

Trees or shrubs, with terete or slightly angled branches, and fibrous roots. Leaves simple, persistent. Flowers fragrant, polygamo-dicœcious or perfect, on ebracteolate pedicels subtended by scale-like bracts, in short axillary racemes or in short axillary or rarely terminal fascicles; calyx minute, 4-toothed or divided, the divisions imbricated in the bud, persistent under the fruit; corolla tubular, 4-lobed, the lobes imbricated in the bud, ovate, obtuse, spreading after anthesis; stamens 2, inserted on the tube of the corolla opposite the lateral lobes of the calyx, or rarely 4; filaments terete, short; anthers ovoid or linear-oblong, blunt, or apiculate by the prolongation of the connective, attached on the back below the middle, 2-celled, the cells opening longitudinally by marginal slits, sometimes rudimentary or 0 in the pistillate flower; ovary subglobose; style columnar, short or elongated, crowned with an entire capitate stigma; ovules laterally attached near the apex of the cell; raphe

ventral. Fruit a fleshy 1-seeded ovoid or globose drupe tipped with the remnants of the style; flesh thin and succulent; stone hard and bony. Seed filling the cavity of the stone; cotyledons flat, much longer than the short superior radicle turned toward the hilum.

Osmanthus with ten species inhabits eastern North America, the Hawaiian Islands, Polynesia, Japan, China, and the Himalayas. *Osmanthus fragrans* Lour., a native of China and the temperate Himalayas, is cultivated in China for its fragrant minute cream-colored or yellow flowers used by the Chinese to perfume tea, and is everywhere a favorite garden plant.

The generic name, from ὀσμή and ἄνθος, relates to the fragrance of the flowers.

1. Osmanthus americanus B. & H. Devil Wood.

Leaves oblong-lanceolate or obovate, acute or rarely rounded and occasionally emarginate at apex, and gradually narrowed and cuneate at base, with thickened revolute margins, when they unfold coated beneath with pale tomentum, and at maturity thick and coriaceous, glabrous, bright green, lustrous above, obscurely reticulate-venulose, 4′–5′ long

Fig. 759

and ½′–2½′ wide, with a broad pale midrib and remote forked primary veins arcuate near the margins; persistent until their second year; petioles stout, ½′–¾′ in length. **Flowers** opening in March from pilose inflorescence-buds formed the previous autumn in the axils of the leaves of the year, the staminate, pistillate, and perfect flowers on different individuals in 3-flowered clusters, sessile or short-pedicellate, in pedunculate cymes or short racemes, with scale-like nearly triangular acute persistent bracts; calyx puberulous, with acute rigid lobes, and much shorter than the creamy white corolla ⅛′ long when expanded, with an elongated tube and short spreading ovate rounded lobes; stamens inserted on the middle of the tube of the corolla, included or slightly exserted, small and often rudimentary in the pistillate flower; ovary abruptly contracted into a stout columnar style crowned with a large exserted capitate stigma, reduced in the staminate flower to a minute point. **Fruit** ripening early in the autumn, oblong or obovoid, 1′ long, dark blue, with thin flesh and a thick or sometimes thin-walled brittle ovoid pointed stone; **seed** ovoid, covered with a chestnut-brown coat marked by broad conspicuous pale veins radiating from the short broad ventral hilum and encircling the seed.

A tree, occasionally 60°–70° high, with a trunk sometimes a foot in diameter, and slender slightly angled ultimately terete branchlets light or red-brown and marked by minute pale lenticels, becoming ashy gray in their second year and roughened by the small elevated orbicular leaf-scars displaying a ring of minute fibro-vascular bundle-scars; usually much

smaller and often shrubby. **Winter-buds** narrow-lanceolate, ½′ long, with 2 thick lanceolate reddish brown puberulous scales. **Bark** of the trunk thin, dark gray or gray tinged with red, and roughened by small thin appressed scales displaying in falling the dark cinnamon red inner bark. **Wood** heavy, very hard and strong, close-grained, difficult to work, dark brown, with thick light brown or yellow sapwood.

Distribution. Usually in hammocks and other places protected from fires near the borders of streams and Pine-barren ponds and swamps, and occasionally on dry sandy uplands; coast region of the south Atlantic and Gulf states from the valley of the lower Cape Fear River, North Carolina, to Lake and Orange Counties, the shores of Tampa Bay, Florida, and westward to eastern Louisiana.

LXI. BORRAGINACEÆ.

Scabrous-pubescent trees or shrubs, with watery juice, and terete branchlets. Leaves simple, alternate or subverticillate, penniveined, persistent or tardily deciduous, without stipules. Flowers regular, perfect, in terminal or axillary dichotomous often scorpioid-branched cymes; calyx usually 5-lobed, persistent under the fruit; corolla hypogynous, 5-lobed, the lobes imbricated in the bud; stamens 5, inserted on the tube of the corolla opposite its lobes; filaments filiform; anthers introrse, 2-celled, the cells opening longitudinally; pistil of 2 carpels; ovary undivided (in the arborescent genera of the United States), sessile on the hypogynous inconspicuous disk, more or less completely 4-celled; style single, 2-branched or parted toward the apex; stigmas clavate or capitate; ovule solitary in each cell. Fruit drupaceous (in the arborescent genera of the United States), tipped with the remnants of the style, with 2–4 nutlets or cells. Seeds ascending; seed-coat membranaceous.

The Borage family with ninety-five genera, mostly of herbaceous plants, is widely distributed and most abundant in temperate regions, especially in the Mediterranean basin and central Asia.

CONSPECTUS OF THE ARBORESCENT GENERA OF THE UNITED STATES.

Branches of the style 2-branched; fruit partly or entirely inclosed in the enlarged calyx.
1. Cordia.

Branches of the style not branched; fruit not inclosed in the calyx.

Calyx valvately splitting into 5 minute teeth; fruit with 2–4 1-seeded nutlets.
2. Beureria.

Calyx 5-parted or cleft, the divisions imbricated in the bud; fruit with 2 2-seeded nutlets.
3. Ehretia.

1. CORDIA L.

Trees or shrubs, with petiolate entire persistent leaves and naked buds. Flowers in terminal scorpioid-branched cymes; calyx tubular or campanulate, conspicuously many-ribbed or rayed, the teeth valvate in the bud; corolla funnel form; anthers oblong-ovate; ovary 4-celled; style slender, elongated, 2-branched above the middle, the branches 2-parted, their division stigmatic to the base; ovule ascending, laterally attached below the middle to the inner angle of the cell, suborthotropous; micropyle superior. Fruit entirely or partly inclosed in the thickened calyx; flesh dry and corky or sweet and juicy; stone thick-walled, hard and bony, 1–4-celled, usually 1 or 2-seeded. Seeds without albumen; embryo filling the cavity of the seed; cotyledons thick and fleshy or membranaceous, longitudinally plicate or corrugated, much shorter than the superior radicle turned toward the hilum.

Cordia with two hundred and fifty species inhabits the tropical and warm extratropical regions of the two hemispheres, the largest number of species being American. Of the four species found within the territory of the United States two are trees. Some of the species are valuable timber-trees, and others are cultivated for their edible fruits.

The generic name is in honor of Valerius Cordus (1515–1544), the German writer on pharmacy and botany.

CONSPECTUS OF THE ARBORESCENT SPECIES OF THE UNITED STATES.

Corolla orange or flame color; fruit inclosed in the smooth glabrous thickened ivory-white calyx; leaves ovate. 1. C. Sebestena (D).

Corolla white with a yellow centre; fruit entirely or partly inclosed in the thin many-ribbed tomentose orange-brown calyx; leaves oval or oblong-ovate. 2. C. Boissieri (E, H).

1. Cordia Sebestena L. Geiger-tree.

Leaves unfolding through a large part of the year, ovate, short-pointed or rounded at apex, rounded, subcordate, or cuneate at base, entire or remotely and coarsely serrate above the middle, covered when they unfold, like the branches of the inflorescence, the outside of the calyx, and the young branchlets, with thick dense rusty tomentum and with short rigid

Fig. 760

pale hairs, and at maturity thick and firm, dark green, scabrous-pubescent, or often nearly glabrous below, reticulate-venulose, 5′–6′ long and 3′–4′ wide, with a broad midrib usually covered below with pale hairs, especially in the axils of remote primary veins connected by conspicuous cross veinlets; petioles stout, pubescent, 1′–1½′ in length. **Flowers** appearing throughout the year on slender pedicels, in open flat cymes 6′–7′ in diameter, some individuals producing flowers with short included stamens and elongated styles, and others with exserted stamens and included styles; calyx tubular, ½′–⅔′ long, and obscurely many-rayed, with short nearly triangular rigid teeth; corolla orange or flame color, puberulous on the outer surface, with a slender tube about twice as long as the calyx and spreading rounded lobes, irregularly undulate on the margins and 1′–1½′ in diameter when fully expanded; ovary conic, glabrous, contracted into a slender style branched near the apex. **Fruit** broad-ovate, rather abruptly narrowed and pointed at apex, concave at base, 1¼′–1½′ long and about ¾′ broad, inclosed in the thickened fibrous calyx smooth and ivory-white on the outer surface; flesh thin, pale, and corky, separable from the irregularly sulcate thick-walled stone gradually narrowed and acuminate at apex, and deeply lobed at base; **seeds** linear-lanceolate, ½′ long, with a delicate white seed-coat.

A tree, in Florida 25°–30° high, with a tall trunk 5′–6′ in diameter, slender upright branches forming a narrow close round-topped head, and stout branchlets with thick pith, dark green at first, becoming ashy gray and marked by large nearly orbicular cordate leaf-scars displaying 2 central circular clusters of fibro-vascular bundle-scars. **Bark** of the trunk ½′–¾′ thick, dark brown, frequently nearly black, and deeply and irregularly divided

into narrow ridges broken on the surface into short thick appressed scales. **Wood** heavy, hard, close-grained, dark brown, with thick light brown or yellow sapwood.

Distribution. Florida, Flamingo near Cape Sable (*A. A. Eaton*) and Madeira Hammock, Monroe County, and on the southern keys; on the Bahama Islands, on most of the Antilles, and in Guiana and New Granada.

Often planted in tropical countries as an ornament of gardens.

2. Cordia Boissieri A. DC. Anacahuita.

Leaves oval to oblong-ovate, acute or rounded at apex, rounded or subcordate at base, entire or obscurely crenulate-serrate, covered when they unfold like the branches of the inflorescence, both surfaces of the calyx and the young branchlets with rusty or dark brown tomentum and short white usually matted hairs, thick and firm, dark green, minutely rugose and more or less scabrous above, coated below with thick soft pale or rufous tomentum, 4′–5′ long and 3′–4′ wide, with a broad midrib, and conspicuous primary veins forked near the margins and connected by cross veinlets; deciduous at the end of their first year; petioles stout, tomentose, 1′–1½′ in length. **Flowers** opening from April to June, slightly fragrant, sessile or short-pedicellate, in open terminal dichotomous cymes; calyx tubular or subcampanulate, conspicuously many-ribbed, with 5 linear acute teeth, and about half as long as the tube of the white corolla puberulous on the outer surface, marked in the throat by a large light yellow spot, the lobes rounded, imbricated in the bud, and 2′ across when

Fig. 761

fully expanded; ovary glabrous, gradually narrowed into a slender 2-branched style. **Fruit** ovoid, 1′ long, about ¾′ broad, pointed at apex, lustrous, bright red-brown, and inclosed entirely or partly by the thin fibrous now conspicuously rayed orange-brown calyx coated on the outer surface with thick short pale tomentum, and often splitting nearly to the base; flesh thin, sweet, and pulpy, separating easily from the ovoid smooth light brown stone gradually narrowed from above the middle, faintly reticulate-veined, and marked by 4 longitudinal lines and at the acuminate apex by a deeply 4-lobed thin cap, thick-walled, hard and bony, deeply lobed at base; **seeds** ovoid, acute, ¼′ long, with a thin delicate pure white coat.

A tree, occasionally 20°–25° high, with a short often crooked trunk 6′–8′ in diameter, stout spreading branches forming a low round-topped head, and stout branchlets, becoming in their second year dark gray or brown, slightly puberulous, and marked by occasional large lenticels and by elevated obcordate leaf-scars; or often a shrub, with numerous stems sometimes only 2° or 3° tall. **Bark** of the trunk thin, gray tinged with red, and irregularly divided into broad flat ridges, the surface ultimately separating into long thin papery

scales. **Wood** light, rather soft, close-grained, and dark brown, with thick light brown sapwood.

Distribution. Dry limestone ridges, and depressions in the desert; valley of the Rio Grande, Texas, and southern New Mexico, southward into Mexico; most abundant and of its largest size in Tamaulipas and Nuevo Leon between the mouth of the Rio Grande and the base of the Sierra Madre.

2. BEURERIA Jacq.

Trees or shrubs, with oblong-obovate or ovate leaves involute in the bud, persistent. Flowers on slender bracteolate pedicels, in terminal corymbose many-flowered cymes, with linear-lanceolate caducous bracts and bractlets; calyx campanulate, 5-toothed, the divisions closed and valvate in the bud; corolla white, campanulate, the lobes broad-ovate, spreading after anthesis; anthers ovoid, rugulose, apiculate; ovary incompletely 4-celled by the development of the 2 parietal placentas, narrowed into a terminal style 2-parted at apex, the divisions more or less coalescent; stigmas capitate; ovules attached on the back near the middle of the inner face of the revolute placentas, anatropous; raphe ventral; micropyle superior. Fruit subglobose, flesh thin; stone somewhat 4-lobed and separable into 4 thick-walled bony 1-seeded nutlets rounded and furnished on the back with a thick spongy longitudinal many-ridged appendage, flattened on their converging inner faces and attached at apex to a filiform column. Seed terete, filling the seminal cell, longitudinally incurved round a rather small cavity opposite an elevated oblong scar on one of the inner faces of the nutlet and connected with the hilum by a narrow passage; seed-coat membranaceous, light brown; embryo axile in fleshy albumen; cotyledons plane; radicle slender, elongated, turned toward the hilum.

Beureria with forty species is confined to tropical America, two species reaching the shores of southern Florida; of these one is a tree and the other *Beureria revoluta* H. B. K. is an arborescent shrub.

The generic name is in honor of J. A. Beurer, an apothecary at Nuremberg.

1. Beureria ovata Meyers.

Beureria havanensis Hitch., not Meyers.

Leaves elliptic to oval or broad-obovate, acute and often apiculate or rounded and then occasionally emarginate at apex, gradually narrowed and cuneate at base entire, densely

Fig. 762

covered when they unfold with white caducous hairs, and at maturity thick, dark yellow-green and lustrous above, paler below, 2½′–3′ long and 1¼′–2′ wide, with slightly thickened

undulate margins, a slender orange-colored midrib, thin primary veins and conspicuous reticulate veinlets more prominent above than below; usually persistent through their second summer; petioles slender, covered when they first appear like the very young branchlets with long white hairs, very soon glabrous, ½′–1′ in length. **Flowers** opening in spring and late in autumn on pedicels ½′ long and furnished near the middle with an acuminate scarious bractlet ¼′ in length and caducous from a persistent base, in open glabrous 15–20-flowered long-stalked cymes 3′–4′ in diameter, with slender branches, and small bracts; calyx gradually narrowed into a stipe-like base, the lobes acuminate, ciliate on the margins; corolla subcampanulate, creamy white, with a short tube somewhat enlarged in the throat, and broad-ovate spreading lobes ¾′ across when expanded; stamens rather longer than the tube of the corolla, anthers much shorter than the filaments; ovary conic, glabrous, gradually contracted into a slender exserted style divided only toward the apex or sometimes nearly entire, and crowned with 2 capitate stigmas. **Fruit** ripening in early autumn or early spring from autumnal flowers, bright orange-red, ½′ in diameter, with a thick tough skin and thin dry flesh inclosing the 4 nutlets, the enlarged spreading calyx becoming sometimes ¾′ across.

A tree, in Florida occasionally 40°–50° high, with a buttressed and often fluted trunk 8′–10′ in diameter, and slender branchlets light red and pilose with caducous hairs when they first appear, becoming in their first winter dark red, orange color or ashy gray, and sometimes roughened by pale lenticels, their thin bark often separating into delicate scales; usually much smaller and often a shrub, with numerous spreading stems. **Winter-buds** minute, globose, covered with hoary tomentum, nearly immersed in the bark. **Bark** of the trunk $\frac{1}{16}$′–⅛′ thick, light brown tinged with red, more or less fissured and divided on the surface into thick plate-like irregular scales. **Wood** hard, strong, very close-grained, brown streaked with orange, with thick hardly distinguishable sapwood.

Distribution. Florida, Cocoanut Grove, Dade County (*Miss O. Rodham*), and on the southern keys; common; on the Bahama Islands and on many of the Antilles.

3. EHRETIA P. Br.

Trees or shrubs, with entire or dentate leaves, and scaly buds. Flowers small, in terminal and axillary scorpioid clusters; calyx open or closed in the bud, the divisions imbricated, ovate or linear; corolla usually white, with a short or cylindric tube and spreading obtuse lobes; ovary oblong-conic, 1-celled before anthesis, becoming incompletely 4-celled by the development of the 2 parietal placentas; style columnar, parted into 2 divisions terminating in capitate stigmas; ovules attached laterally near the middle on the inner face of the revolute placentas, anatropous; raphe ventral; micropyle superior. Fruit fleshy, small, globose, with thin flesh; stone separable into 2 2-celled thick-walled bony nutlets rounded on the back, plane on the inner face, and attached to a thin axile column. Seed terete, usually erect, filling the longitudinally incurved seminal cavity; seed-coat thin, membranaceous, light brown; embryo axile in thin albumen; cotyledons ovate, plane, shorter than the elongated superior radicle turned toward the hilum.

Ehretia with about forty species is widely distributed through tropical and warm extratropical regions of the two hemispheres, with a single species extending into southeastern Texas.

The generic name commemorates the artistic and scientific labors of the German botanical artist, George Dionysius Ehret (1708–1770).

1. Ehretia elliptica DC. Anaqua. Knackaway.

Leaves oval or oblong, pointed and apiculate at apex, gradually rounded or cuneate at base, entire or occasionally furnished above the middle with a few broad teeth, conspicuously reticulate-venulose, unfolding late in winter and then thin, light green, lustrous, minutely tuberculate and pilose above, and covered below like the branches of the inflorescence, the outer surface of the calyx, and the young branchlets with rigid pale hairs, often furnished with axillary tufts of white hairs, and at maturity subcoriaceous, dark green and

roughened on the upper surface by the enlarged circular crowded pale tubercles, and more or less covered with soft pale or rufous pubescence on the lower surface, especially on the narrow midrib, and numerous primary veins arcuate near the margins; irregularly deciduous during the winter; petioles stout, grooved, pubescent, $\frac{1}{8}'$–$\frac{1}{4}'$ in length. **Flowers** opening from autumn to early spring, in compact racemose scorpioid-branched panicles 2′–3′ long and

Fig. 763

broad, on short leafy branches of the year, with linear acute deciduous bracts about $\frac{1}{4}'$ long; calyx open in the bud, divided to the base into 5 linear acute divisions and nearly as long as the campanulate tube of the corolla, with ovate thin white lobes $\frac{1}{2}'$ across when expanded. **Fruit** ripening in autumn and spring, light yellow, $\frac{1}{4}'$ in diameter, with thin sweet rather juicy edible flesh, and 2 2-seeded nutlets.

A tree, sometimes 40°–50° high, with a trunk occasionally 3° in diameter, stout spreading branches forming a handsome compact round-topped head, and slender branchlets, without a terminal bud, covered when they first appear, like the under surface of the leaves, the branches of the inflorescence, and the outer surface of the calyx of the flower, with rigid hirsute pale hairs, becoming in their first winter light brown tinged with red, sometimes puberulous, often roughened by numerous pale lenticels, and by small depressed obcordate leaf-scars displaying a short lunate row of fibro-vascular bundle-scars; usually much smaller within the territory of the United States, and often a low shrub. **Winter-buds**: axillary, minute, 1 or 2 together, superposed, buried in the bark, and covered by 2 pairs of dark scales persistent on the base of the growing branchlet and at maturity acute, dark chestnut-brown, coated with pale hairs, and sometimes $\frac{1}{4}'$ in length. **Bark** of young stems and of the branches thin, light brown, and broken into thick appressed scales, becoming on old trunks sometimes 1′ thick, deeply furrowed and divided into long thick irregular plate-like scales gray or reddish brown on the surface and separating into thin flakes. **Wood** heavy, hard, not strong, close-grained, difficult to split, light brown, with thick slightly lighter colored sapwood.

Distribution. River valleys in fertile soil, or as a shrub on dry barren ridges; valleys of the upper Marcos and of the Guadalupe Rivers, Texas, to the Rio Grande; often extremely common on the bottom-lands, and probably of its largest size in the United States on the Guadalupe and Nueces Rivers sixty or seventy miles from the coast; through Nuevo Leon and Coahuila to the mountains of San Luis Potosí.

Often planted as a shade-tree in the streets of the cities and towns of western Texas and northeastern Mexico.

LXII. VERBENACEÆ.

Trees or shrubs, with opposite simple entire persistent leaves, without stipules. Flowers perfect; calyx 5-toothed or parted, persistent under the fruit; corolla 4 or 5-lobed, the lobes imbricated in the bud; stamens 4, inserted on the tube of the corolla in pairs of different lengths, anthers 2-celled, introrse, the cells opening longitudinally; ovary sessile on the annular disk; style simple, 2-lobed and stigmatic at apex. Fruit a fleshy drupe or a capsule.

The Verbena family with seventy-eight genera, largely composed of herbaceous plants, is widely scattered through temperate and tropical regions. Some of the species are important timber-trees, the most valuable being the Teak, *Tectoria grandis* L. f., of southeastern Asia and the Malay Archipelago, and some of the tropical species of Vitex.

CONSPECTUS OF THE ARBORESCENT GENERA OF THE UNITED STATES.

Flowers in axillary or terminal racemes; staminodium 1; ovary imperfectly 4-celled; fruit a fleshy drupe. **1. Citharexylon.**

Flowers cymose in pedunculate spikes or heads; staminodium 0; ovary 1-celled; fruit a capsule. **2. Avicennia.**

1. CITHAREXYLON L.

Trees or shrubs, with coriaceous lustrous leaves, slightly angled branchlets, without a terminal bud, and with minute axillary buds. Flowers small, on short ebracteolate pedicels, alternate or scattered on the filiform rachis of a slender raceme; calyx membranaceous, tubular-campanulate, truncate, minutely 5-toothed, spreading and cup-shaped under the fruit; corolla salver-form, usually white, the spreading limb somewhat oblique, 5-lobed, the lobes broad-ovate, rounded, slightly unequal, the 2 posterior exterior, sometimes reduced to staminodia; stamens included; filaments short, filiform, slightly thickened at base, the 2 anterior filaments longer than the others; anthers oblong; staminodium 1, posterior, linear, acute, rarely fertile; ovary ovoid, incompletely 4-celled by the development of two parietal placentas, gradually narrowed into a short included style; ovule solitary in each cell, erect, attached laterally near the base, ascending, anatropous; micropyle inferior. Fruit a 2-stoned 4-seeded fleshy drupe tipped with the remnants of the style, with thin flesh and a thick-walled bony stone separable into 2 2-seeded compressed smooth light brown nutlets rounded on the back and concave on the inner face. Seed erect, without albumen, filling the seminal cavity; seed-coat membranaceous, light brown; embryo subterete, straight; cotyledons thick and fleshy, oblong, much longer than the short inferior radicle turned toward the oblong basal hilum.

Citharexylon with about twenty species is confined to tropical America, where it is distributed from southern Florida through the West Indies to southern Mexico, Lower California, Bolivia, and Brazil.

The generic name, from κιθάρα and ξύλον, is a translation of the English West Indian name Fiddle Wood, a corruption of the earlier French-colonial Bois Fidèle, in allusion to the strength and toughness of the wood of the trees of this genus.

1. Citharexylon fruticosum L. Fiddle Wood.

Citharexylon villosum Jacq.

Leaves oblong-obovate to oblong, acute, acuminate, rounded or emarginate at apex, and gradually narrowed at base, with thickened slightly revolute margins, and glabrous or coated with short pubescence (var. *villosum* Schulz); conspicuously reticulate-venulose, pale green, 3′–4′ long and 1′–1½′ wide, with a broad pale midrib rounded on the upper side and remote prominent arcuate veins; petioles stout, grooved, ⅔′ in length, separating in falling from an elevated nearly circular persistent woody base. Flowers fragrant, appearing throughout the year on slender pedicels from the axils of scarious pubescent bracts, in drooping axillary pubescent racemes crowded near the end of the branches and 2′–4′ long; calyx coated with pale hairs, or sometimes nearly glabrous; corolla ⅛′ across the expanded

lobes of the limb, and covered on the inner surface of the tube with pale hairs; staminodium minute. **Fruit** subglobose to oblong-ovoid, light red-brown, very lustrous, $\frac{1}{3}'$ in

Fig. 764

diameter, with thin sweet rather juicy flesh, and inclosed nearly to the middle in the cup-like pale brown slightly and irregularly lobed or sometimes nearly entire calyx; **seeds** oblong, narrowed at the rounded ends, about $\frac{1}{8}'$ long.

A tree, in Florida rarely more than 30° high, with a trunk 4′–7′ in diameter, slender upright branches forming a narrow irregularly shaped head, and slender slightly many-angled branchlets light yellow and covered with pale simple caducous hairs or pubescent when they first appear, becoming in their second year terete and ashy gray; or often a shrub, with numerous low stems. **Winter-buds** globose, nearly immersed in the bark, and covered with hoary pubescence. **Bark** of the trunk $\frac{1}{16}'$–$\frac{1}{8}'$ thick, light brown tinged with red, the surface separating into minute appressed scales. **Wood** heavy, exceedingly hard, strong, close-grained, clear bright red, with thin lighter colored sapwood.

Distribution. Florida, Cape Canaveral to the southern keys; common and of its largest size in the United States on the shores of Bay Biscayne near the mouth of the Miami River, Dade County; northward usually a low shrub; on the Bahama Islands and on many of the Antilles.

2. AVICENNIA L.

Trees, with coriaceous persistent leaves, stout pithy branches thickened at the nodes and marked by interpetiolar lines, and long thick horizontal roots producing numerous short vertical thick and fleshy leafless stems rising above the surface of the soil. Flowers opposite, cymose, in centripetal pedunculate spikes or heads, closely invested by a bract and 2 bractlets, the peduncles solitary or in pairs in the axils of upper leaves and ternate on the end of the branches, their bracts and bractlets concave, acute, apiculate, keeled on the back, scarious, slightly ciliate on the margins, shorter than the corolla, persistent under the fruit; calyx cup-shaped, coated like the bracts and bractlets with canescent pubescence, divided nearly to the base into 5 concave ovate rounded lobes imbricated in the bud; corolla campanulate, white, with a straight cylindric tube shorter than the glabrous or tomentose spreading 4-lobed limb, the posterior lobe usually larger than the others; stamens exserted; filaments short, filiform, slightly thickened at base; anthers ovoid; ovary ovoid, pubescent, 1-celled, gradually narrowed into an elongated slender style divided at apex into 2 lobes stigmatic on their inner face; ovules 4, suspended from the summit of a free central placenta, orthotropous, naked. Fruit an ovoid oblique compressed 1-seeded capsule apiculate

at apex; pericarp thin, light green, villose-pubescent on the outer surface, longitudinally veined on the inner surface, opening by the ventral suture and displaying the embryo enlarging before separating from the branch, ultimately 2-valved. Seed naked, without albumen; embryo filling the cavity of the fruit, light green; cotyledons thick and fleshy, broader than long, slightly pointed, deeply cordate at base, unequal, conduplicate; radicle elongated, clavate, retrorsely hirsute, inferior, descending obliquely and included between the lobes of the cotyledons slightly attached near the apex in the bottom of the capsule to the withered columella by a minute papillose point; plumule hairy.

Avicennia with three species is widely distributed on maritime shores of the tropics of the two worlds, with one species reaching those of the southern United States. Avicennia produces hard strong wood. The bark is rich in tannic acid, and is used for tanning leather. The chief value of these trees is in their ability to live on low tidal shores by the structure of the embryo, which is growing and ready to take root as soon as it falls into the soft mud, and in the long horizontal roots furnished with short vertical fleshy leafless branches or aerating roots, forming a close network which holds the soil together and prevents it from being washed away by outflowing tides, and extends the growth of the tree by numerous stems which soon form dense thickets.

The generic name is in honor of the illustrious physician of the Orient, Avicenna of Bokhara (980–1036).

1. Avicennia nitida Jacq. Black Mangrove.

Leaves oblong or lanceolate-elliptic, rounded or acute at apex and gradually narrowed at base, dark green and often lustrous above, hoary-tomentulose below, 2′–3′ long and ¾′–1½′ wide, with slightly thickened revolute margins, a broad midrib thickened and grooved

Fig. 765

toward the base on the upper side, and oblique primary veins arcuate and joined close to the margins, conspicuous on the 2 surfaces, and connected by prominent reticulate veinlets; appearing irregularly and falling early in their second season; petioles broad, channeled, enlarged at base, and about ½′ in length. **Flowers** produced continuously throughout the year, their bracts and bractlets nearly ¼′ long, coated with pale or slightly rufous pubescence and about as long as the lobes of the calyx, in few-flowered short spikes on stout 4-angled canescent peduncles ½′–1½′ in length, the lateral peduncles of the ternate terminal cluster subtended by oblong acute bracts ½′ long; corolla ½′ across the expanded slightly tomentose lobes, and nearly closed in the throat. **Fruit** 1′–1½′ long and ¾′–1′ wide.

A tree, occasionally 60°–70° high, with a short trunk rarely 2° in diameter, spreading branches forming a broad round-topped head, and branchlets at first slightly angled, coated

with fine hoary deciduous pubescence, and light orange color, becoming in their second year more or less contorted, light or dark gray, conspicuously marked by the interpetiolar lines and by horizontal leaf-scars displaying a central row of fibro-vascular bundle-scars; usually not more than 20°–30° tall, with a short slender stem, and toward the northern limit of its range a low shrub. **Bark** of the trunk $\frac{1}{4}'$–$\frac{1}{2}'$ thick, roughened with thin irregularly appressed dark brown scales tinged with red, and in falling displaying the bright orange-red inner bark. **Wood** very heavy, hard, rather coarse-grained, with numerous medullary rays and eccentric layers of annual growth, dark brown or nearly black, with thick brown sapwood.

Distribution. Florida, St. Augustine to the southern keys on the east coast, and from Cedar Keys to Cape Sable on the west coast; on some of the islands in Mississippi Sound, and on the shore of Terrebonne and Cameron Parishes, and on most of their islands, Louisiana; on the Bahama Islands, on many of the Antilles, and southward to Brazil; and on the west coast of Africa; in the United States of its largest size in Florida just north of Cape Sable; north of Matanzas Inlet on the east coast of Florida usually with stems only a few feet tall.

LXIII. SOLANACEÆ.

Trees, shrubs or herbs, with colorless juice and rank smelling foliage, alternate rarely opposite leaves, without stipules, and perfect regular yellow, white or purple flowers on ebracteolate pedicels in usually dichotomous cymes; calyx campanulate, usually 5-lobed, the lobes slightly imbricated or valvate, usually persistent; corolla gamopetalous, usually 5, rarely 4-lobed, the lobes induplicate-valvate or plicate in the bud; stamens inserted on the tube of the corolla and alternate with and as many as its lobes, equal or unequal; filaments filiform or dilated at base; anthers 2-celled, introrse, opening by apical or longitudinal slits, disk pulvinate or annular, entire, sinuate or 2-lobed or 0; ovary sessile or stipitate on the disk, 2 or rarely 3–5-celled; style slender, terminating in a small or more or less dilated stigma; ovules numerous, attached in many series on the axile placenta, rarely few or solitary, anatropous or slightly amphitropous. Fruit baccate or capsular. Seeds numerous; testa membranaceous or crustaceous; embryo usually slender and curved in fleshy albumen; cotyledons semiterete, shorter than the radicle turned toward the hilum.

A family of 83 genera widely distributed in tropical and temperate regions; often producing fruit with narcotic or poisonous properties, and containing among its useful members the Potato and the Tomato.

1. SOLANUM L.

Herbs, shrubs or rarely trees. Leaves alternate, lobed or pinnatifid, persistent or deciduous. Flowers in mostly lateral, extra-axillary or axillary clusters; calyx and corolla 5, rarely 4–10-parted, the calyx persistent under the fruit, corolla rotate in the bud; stamens 5, rarely 4–6, exserted; filaments short; anthers oblong or acuminate, rarely ovoid, converging round the style, opening at apex by two pores; disk not conspicuous, or annular; ovary usually 2, rarely 3 or 4-celled; style simple; stigma usually small; ovules numerous. Fruit baccate, often surrounded by the enlarged calyx, usually globose and juicy; seeds compressed, orbicular or subreniform.

Solanum with some 1200 species is widely distributed through the tropics, with a few species extending into cooler regions, the larger number of species occurring in the New World.

The name is of uncertain derivation.

1. Solanum verbascifolium L.

Leaves ovate to elliptic or oblong, acute or acuminate at apex, rounded or cuneate at base, entire, thickly coated when they unfold with hoary tomentum, and at maturity thin, yellow-green and stellate-pubescent on the upper surface, paler and more densely stellate-pubescent on the lower surface, 5′–7′ long and 1′–3′ wide, with slightly undulate margins,

a prominent midrib and slender primary veins; persistent; petioles slender, densely stellate-pubescent, $\frac{3}{4}'$–$1'$ in length. **Flowers** appearing throughout the year on pedicels $\frac{1}{4}'$ long and much thickened at maturity, in broad many-flowered dichotomous stellate-

Fig. 766

pubescent cymes on peduncles $1'$–$4'$ in length from the axils of upper leaves; calyx about $\frac{1}{2}'$ long, densely stellate, the lobes triangular-ovate; corolla about $\frac{3}{4}'$–$1'$ wide after the expansion of the oblong-ovate lobes; stamens exserted. **Fruit** globose, yellow, $\frac{1}{2}'$–$\frac{3}{4}'$ in diameter, surrounded at base by the densely stellate calyx, with ovate acute lobes about $\frac{1}{6}'$ long; **seeds** nearly orbicular to obovoid, much compressed, yellow, $\frac{1}{12}'$ in diameter.

A tree, rarely 20° high, with a trunk $4'$ or $5'$ in diameter, spreading branches forming a flat-topped head, and stout unarmed branchlets densely stellate-tomentose during their first season, becoming glabrous and light orange-brown or gray-brown in the following year; usually smaller and generally a shrub. **Bark** of the trunk thin, close, much roughened by many wart-like excrescences, light greenish or yellowish gray.

Florida, rich hummocks, Merritt's Island on the east coast, southward to the shores of Bay Biscayne, and to the Cape Sable region; on the Bahama Islands, and many of the Antilles, in Mexico and Central America, in the tropics of the Old World and in southeastern China; now thoroughly established but more probably introduced than indigenous in Florida.

LXIV. BIGNONIACEÆ.

Trees or shrubs, with watery juice, and opposite or rarely alternate simple (in the arborescent genera of the United States) leaves, without stipules. Flowers perfect, large and showy; calyx closed in the bud, bilabiately splitting in anthesis; corolla hypogynous, 2-lipped, 5-lobed, the lobes imbricated in the bud; stamens 2 or 4, inserted on the corolla, introrse; anthers 2-celled, the cells opening longitudinally; staminodia 1 or 3; ovary sessile, 1 or 2-celled, gradually narrowed into a slender simple style 2-lobed and stigmatic at apex; ovules numerous, horizontal, anatropous; raphe ventral; micropyle superior. Fruit a linear woody loculicidally 2-valved capsule, or a berry. Seeds without albumen; embryo filling the cavity of the seed.

The Bignonia family with about one hundred genera, many of them of scandent plants, is widely distributed in the tropics and most abundant in the New World, with a few genera extending into temperate regions. Of the five genera of the United States three are arborescent. Many of the species are important timber-trees.

CONSPECTUS OF THE ARBORESCENT GENERA OF THE UNITED STATES.

Fruit a linear woody capsule; ovary 2-celled; leaves thin, deciduous.
Stamens 4; staminodium 1; leaves linear, often alternate or scattered. 1. Chilopsis.
Stamens 2; staminodia 3; leaves oblong-ovate, mostly opposite. 2. Catalpa.
Fruit a berry; stamens 4; staminodium 1; ovary 1-celled; leaves coriaceous, persistent. 3. Enallagma.

1. CHILOPSIS D. Don.

A tree, with slender terete branches, without a terminal bud, minute compressed rusty-pubescent axillary buds covered by several imbricated scales, those of the inner rows accrescent, deeply furrowed bark, soft coarse-grained dark-colored wood, and fibrous roots. Leaves opposite, alternate or scattered, involute in the bud, linear or linear-lanceolate, long-pointed, entire, 3-nerved, the lateral nerves obscure, reticulate-venulose, thin, light green, smooth or glutinous, short-petiolate or sessile from an enlarged base, deciduous, in falling leaving small elevated suborbicular scars. Flowers on slender pedicels from the axils of ovate acute scarious tomentose deciduous bracts and bibracteolate near the middle, in short puberulous crowded racemes or rarely panicles terminal on leafy branches of the year; calyx pale pubescent, puberulous or rarely glabrous, closed before anthesis into an ovoid rounded apiculate bud splitting to the base into 2 ovate divisions, minutely toothed or long-pointed at apex, the upper with 3, the lower with 2 rigid teeth, membranaceous, dark green; corolla white shaded into pale purple or rarely white, slightly oblique, enlarged and blotched with yellow in the throat, the limb undulate-margined, the upper lip 2-lobed, the lower unequally 3-lobed, the central lobe much longer than the others; stamens 4, inserted in 1 row near the base of the corolla in pairs, introrse; filaments filiform, glabrous, the anterior nearly twice as long as the posterior; anther oblong, the cells divergent in anthesis; staminodium 1, posterior, linear, acute; disk thin, nearly obsolete; ovary 2-celled, conic, glabrous, divided at apex into 2 ovate flat rounded lobes; ovules inserted in many series on a central placenta. Fruit a slender elongated thin-walled capsule gradually narrowed from the middle to the ends, splitting into 2 concave valves. Seeds numerous, inserted in 2 ranks near the margin of the thin flat woody septum free from the walls of the capsule, compressed, oblong; seed-coat thin, light brown, longitudinally veined, produced into broad lateral wings divided at their rounded ends into a long fringe of thin soft white hairs; cotyledons plane, broader than long, slightly 2-lobed, and rounded laterally; radicle short, erect, turned toward the oblong basal hilum.

The genus is represented by a single species, a native of the region adjacent to the boundary between the United States and Mexico.

The generic name, from χεῖλος and ὄψις, is without special significance.

1. Chilopsis linearis DC. Desert Willow.

Leaves unfolding in early spring, 6′–12′ long and $\frac{1}{4}$′–$\frac{1}{3}$′ wide; deciduous during the following winter. **Flowers** appearing in early summer in racemes or narrow panicles 3′–4′ long, and continuing to open for several months in succession, $\frac{3}{4}$′–$1\frac{1}{2}$′ long and $\frac{3}{4}$′–$1\frac{1}{4}$′ across the expanded lobes of the corolla. **Fruit** ripening in the autumn, 7′–12′ long, $\frac{1}{4}$′ thick in the middle, persistent on the branches during the winter; **seeds** $\frac{1}{3}$′ long and $\frac{1}{8}$′ wide.

A tree, 20°–30° high, with a trunk usually more or less reclining, often hollow, and sometimes a foot in diameter, slender upright branches forming a narrow head, and branchlets glabrous or covered with dense tomentum when they first appear, light chestnut-brown during their first season, later becoming darker and tinged with red, or sometimes ashy gray; or often a straggling shrub. **Bark** of the trunk $\frac{1}{8}$′–$\frac{1}{4}$′ thick, dark brown, and divided into broad branching ridges broken on the surface into small thick plate-like scales. **Wood** soft, not strong, close-grained, brown streaked with yellow, with thin light-colored sapwood of 2 or 3 layers of annual growth.

Distribution. Banks of streams, and depressions in the desert, usually in dry gravelly

Fig. 767

porous soil; valley of the lower Rio Grande, and through western Texas, southern New Mexico, Arizona, southern Utah and Nevada to San Jacinto Valley, San Diego County, California; in northern Mexico and Lower California (Calamujuit).

Occasionally cultivated as an ornamental plant in the southern states, and in Mexico.

2. CATALPA Scop.

Trees, with stout terete branchlets, without a terminal bud, minute globose axillary buds nearly immersed in the bark and covered by numerous scales, the inner accrescent, thick pith, thin scaly bark, soft light-colored wood very durable in contact with the soil, and fibrous roots. Leaves opposite or in verticels of 3, involute in the bud, entire or lobed, oblong-ovate, often cordate, long-petiolate, deciduous. Flowers on slender bracteolate pedicels, in terminal compound trichotomously branched panicles or corymbs, with linear-lanceolate deciduous bracts and bractlets; calyx membranaceous, subglobose, closed and apiculate in the bud, in anthesis splitting nearly to the base into 2 broad-ovate entire pointed apiculate lobes; corolla thin, variously marked and spotted on the inner surface, inserted on the nearly obsolete disk, the tube broad, campanulate, occasionally furnished on the upper side near the base with an external lobed appendage, and oblique and enlarged above into a broad limb, with spreading lips undulate on the margin, the posterior 2-parted, the anterior deeply 3-lobed; stamens and staminodia inserted near the base of the corolla; stamens 2, anterior, included or slightly exserted; filaments flattened, arcuate; anthers oblong, carried to the rear of the corolla and face to face on either side of the stigma by a half turn of the filaments near their base, the cells divergent in anthesis; staminodia 3, free, filiform, minute or rudimentary; ovary 2-celled, sessile on the hypogynous nearly obsolete disk, abruptly contracted into an elongated filiform style divided at apex into 2 stigmatic lobes exserted above the anthers; ovules inserted in many series on a central placenta. Fruit an elongated subterete capsule tapering from the middle to the ends, persistent on the branches during the winter, ultimately splitting into 2 valves. Seeds numerous, compressed, oblong, inserted in 2–4 ranks near the margin of the flat or more or less thickened woody septum free from the walls of the capsule; seed-coat thin, light brown or silvery gray, longitudinally veined, produced into broad lateral wings notched at base of the seed and divided at their narrowed or rounded ends into tufts of long coarse white hairs; cotyledons plane, broader than long, slightly 2-lobed, rounded laterally; radicle short, erect, turned toward the oblong conspicuous basal hilum.

Catalpa with seven species is confined to the eastern United States, the West Indies, and eastern China, two of the species being North American. Catalpa contains a bitter principle and is a tonic and diuretic.

The generic name is that by which one of the North American species was known among the Cherokee Indians.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Flowers in many-flowered crowded panicles; calyx glabrous; corolla thickly spotted on the inner surface; fruit slender, thin-walled; leaves short-acuminate.

1. C. bignonioides (C).

Flowers in few-flowered open panicles; calyx often sparingly villose or pubescent; corolla inconspicuously spotted; fruit stout, thick-walled; leaves caudate-acuminate.

2. C. speciosa (A, C).

1. Catalpa bignonioides Walt. Catalpa. Indian Bean.

Catalpa Catalpa Karst.

Leaves broad-ovate, rather abruptly contracted into a slender point or sometimes rounded at apex, cordate at base, entire or often laterally lobed, coated below when they unfold with pale tomentum and pilose above, and at maturity thin and firm, light green and glabrous on the upper surface, pale and pubescent on the lower surface, 5′–6′ long and 4′–5′ wide, with a prominent midrib, and primary veins arcuate near the margins, connected by reticulate veinlets and furnished in the axils with clusters of dark hairs; turning black and falling after the first severe frost in the autumn; petioles stout, terete, 5′–6′ in length. **Flowers** opening at the end of May or in June, on slender sparingly villose or glabrous pedicels, in compact many-flowered panicles 8′–10′ long and broad, with light green branches tinged with purple; calyx ½′ long, glabrous, green or light purple; corolla white, nearly 2′ long, 1½′ wide, marked on the inner surface on the lower side by 2 rows of yellow blotches following 2 parallel ridges or folds, and in the throat and on the lower lobes

Fig. 768

of the limb by crowded conspicuous purple spots. **Fruit** ripening in the autumn, in thick-branched orange-colored panicles, remaining unopened during the winter, 6′–20′ long and ¼′–⅓′ thick in the middle, with a thin wall bright chestnut-brown on the outer surface and light olive-brown and lustrous on the inner surface, splitting in the spring into 2 flat valves; **seeds** about 1′ long, ¼′ wide, silvery gray, with pointed wings terminating in long pencil-shaped tufts of white hairs.

A tree, rarely 60° high, with a short trunk 3°–4° in diameter, long heavy brittle branches forming a broad head, and dichotomous branchlets green shaded with purple when they first appear, and during their first winter thickened at the nodes, slightly puberulous, lustrous, light orange color or gray-brown, covered with a slight glaucous bloom, marked by

large pale scattered lenticels, and by large oval elevated leaf-scars containing a circle of conspicuous fibro-vascular bundle-scars, becoming in their third or fourth year, reddish brown and marked by a network of thin flat brown ridges. **Winter-buds** covered by chestnut-brown broad-ovate rounded slightly puberulous loosely imbricated scales, those of the inner ranks when fully grown bright green, pubescent, and sometimes 2′ in length. **Bark** of the trunk $\frac{1}{4}$′–$\frac{1}{3}$′ thick, light brown tinged with red, and separating on the surface into large thin irregular scales. **Wood** not strong, coarse-grained, light brown, with lighter colored often nearly white sapwood of 1 or 2 layers of annual growth; used and highly valued for fence-posts and rails.

Distribution. Usually supposed to be indigenous on the banks of the rivers of southwestern Georgia, western Florida, and central Alabama and Mississippi, and now widely naturalized through the south Atlantic states and in Kentucky and Tennessee.

Often planted for the decoration of parks and gardens in the eastern United States, and hardy as far north as eastern New England, and in western, central, and southern Europe. A dwarf round-headed form (var. *nana* Bur.) of unknown origin is often cultivated under the erroneous name of *C. Bungei* Hort. not C. A. Meyer.

× *Catalpa hybrida* Spaeth a hybrid of this species and the Chinese *C. ovata* G. Don is occasionally cultivated.

2. Catalpa speciosa Engelm. Western Catalpa.

Leaves oval, long-pointed, cordate at base, and usually entire or furnished with 1 or 2 lateral teeth, pilose above when they unfold and covered below and on the petioles with pale or rufous tomentum, and at maturity thick and firm, dark green on the upper surface and covered with soft pubescence on the lower surface, especially on the stout midrib and

Fig. 769

the primary veins furnished in their axils with large clusters of dark glands, 10′–12′ long and 7′–8′ wide; turning black and falling after the first severe frost of the autumn; petioles stout, terete, 4′–6′ in length. **Flowers** appearing late in May or early in June, on slender purple glabrous pedicels furnished near the middle with 1–3 bractlets, in open few-flowered panicles 5′–6′ long and broad, with green or purple branches marked by orange-colored lenticels, the lowest branches often in the axils of small leaves; calyx purple, often sparingly villose or pubescent on the outer surface; corolla white, often spotted externally with purple near the base, about 2′ long and $2\frac{1}{2}$′ wide, and marked internally on the lower side by 2 bands of yellow blotches following 2 lateral ridges and by occasional purple spots spreading over the lobes of the lower lip of the limb; filaments marked near the base by oblong purple spots. **Fruit** 8′–20′ long, $\frac{1}{2}$′–$\frac{3}{4}$′ in diameter near the middle, with a thick wall splitting toward spring into 2 concave valves; **seeds** 1′ long and $\frac{1}{3}$′ wide, with a light brown coat, and wings rounded at the ends and terminating in a fringe of short hairs.

A tree, in the forest occasionally 120° high, with a tall straight trunk rarely 4½° in diameter, slender branches forming a narrow round-topped head, and branchlets light green often tinged with purple and pilose with scattered pale hairs when they first appear, light orange color or reddish brown, covered with a slight bloom during their first winter, and marked by numerous conspicuous pale lenticels and by the elevated oval leaf-scars ¼′ long and displaying a circular row of large fibro-vascular bundle-scars, becoming darker in their second and third years; usually smaller, and in open situations rarely more than 50° high, with a short trunk and a broad head of spreading branches. **Winter-buds** covered by loosely imbricated ovate chestnut-brown scales keeled on the back, slightly apiculate at apex, those of the inner ranks at maturity foliaceous, obovate, acute, gradually narrowed below to a sessile base, many-nerved with dark veins, pubescent on the lower surface, and sometimes 2½′ long and ¾′ wide. **Bark** of the trunk ¾′–1′ thick, brown tinged with red, and broken on the surface into thick scales. **Wood** light, soft, not strong, coarse-grained, light brown, with thin nearly white sapwood of 1 or 2 layers of annual growth; largely used for fence-posts, rails, telegraph and telephone poles, and occasionally for furniture and the interior finish of houses.

Distribution. Borders of streams and ponds, and fertile often inundated bottom-lands; valley of the Vermilion River, Illinois, through southern Illinois and Indiana, western Kentucky and Tennessee, southeastern Missouri and northeastern Arkansas; very abundant and probably of its largest size in southern Illinois and Indiana; naturalized through cultivation in southern Arkansas, western Louisiana, and eastern Texas.

Often planted in the prairie region of the Mississippi basin as a timber-tree, and as an ornament of parks and gardens in the eastern states, and now in many other countries with a temperate climate.

3. ENALLAGMA Bail.

Trees, with scaly bark, and stout slightly angled branchlets. Leaves alternate, short-petiolate, persistent. Flowers solitary, or in few-flowered fascicles on long bibracteolate peduncles from the axils of upper leaves or from the sides of the branches; calyx coriaceous, splitting in anthesis into 2 unequal broad divisions, or sometimes slightly 5-lobed, deciduous; corolla inserted under the hypogynous pulvinate fleshy disk, yellow streaked with purple, or dingy purple, tubular-campanulate, more or less ventricose on the lower side by a transverse fold, abruptly dilated into an oblique 2-lipped obscurely 5-lobed laciniately toothed limb; stamens 4, inserted in 2 ranks on the tube of the corolla, in pairs of different lengths, introrse, included or slightly exserted; filaments filiform; anthers oblong, the cells divergent; staminodium solitary, posterior, often 0; ovary sessile, 1-celled, ovate-conic, gradually narrowed into an elongated simple exserted style; stigma terminal, 2-lobed, the lobes stigmatic on their inner face, or entire; ovules in many ranks on 2 thickened 2-lobed lateral parietal placentas. Fruit baccate, oblong or ovoid; indehiscent, umbonate at apex, many-seeded; pericarp thin and brittle; becoming hard, light brown and separable into 2 layers, the inner membranaceous, filled with the united and thickened fleshy viscid placentas attached at base by a cluster of thick fibro-vascular bundles. Seeds imbedded irregularly in the placental mass, compressed, suborbicular, cordate above and below and deeply grooved on the convex faces; embryo filling the seminal cavity, flattened, thick and fleshy, deeply grooved, becoming black in drying; radicle minute, turned toward the lateral hilum.

Enallagma with three or four species is distributed from southern Florida through the Antilles to southern Mexico and Central America.

1. Enallagma cucurbitina Urb. Black Calabash Tree.

Crescentia cucurbitina L.

Leaves crowded near the end of the branches, obovate-oblong or ovate-oblong, contracted into a short broad point or rarely rounded or emarginate at apex, gradually narrowed and cuneate at base, and entire, with cartilaginous slightly revolute margins, cori-

aceous, dark green and lustrous above, paler and yellow-green below, 6′–8′ long and 1½′–4′ wide, with a broad stout midrib deeply impressed on the upper side, conspicuous primary veins arcuate and united near the margins, and reticulate veinlets; unfolding in the

Fig. 770

spring, and persistent until their second year; petioles thick, covered with glands, and about ¼′ in length. **Flowers** appearing in April and May and also in autumn, bad-smelling, on thick drooping pedicels solitary in the axils of upper leaves, 1½′–2′ long, furnished below the middle with 2 minute rigid acute bractlets and enlarged at apex into the thick oblique receptacle; calyx light green and slightly glandular at base, splitting nearly to the bottom into 2 ovate pointed lobes nearly as long as the tube of the corolla; corolla thick and leathery, dull purple or creamy white, and marked by narrow purple bands on the lower side, and 2′ long, with a narrow tube creamy white within and slightly contracted above the base, the transverse fold near its apex, the limb erosely cut on the margins and obscurely 2-lipped, the upper lip slightly divided into 2 reflexed lobes, the lower obscurely 3-lobed; stamens inserted near the middle of the tube of the corolla, those of the anterior pair below the others and above the linear staminodium; ovary obliquely conic; stigma 2-lobed. **Fruit** ovoid or oblong, 3′–4′ long, 1½′–2′ wide, dark green, minutely rugose-punctulate, and marked with 4 obscure longitudinal ridges corresponding with the margins and midrib of the carpellary leaves, raised on the thickened woody disk and pendent on a stout drooping stalk 1½′–2′ long and much enlarged at apex; shell $\frac{1}{16}$′ thick, ultimately hard and brittle, lustrous on the outer surface and lined with a thin membranaceous shining light brown coat marked by the broad placental scars; **seeds** ⅝′ long and broad and ¼′ thick, with a minute lateral hilum just above the basal sinus; seed-coat of 2 layers, the outer thin, dark reddish brown, rugose, and separable from the thick pale felt-like inner layer; cotyledons with 2 ear-like folds near the base, inclosing the radicle in their lower sinus.

A tree, in Florida 18°–20° high, with a trunk 4′–5′ in diameter, long slender drooping branches covered with wart-like excrescences, and stout slightly angled branchlets roughened and somewhat enlarged at the nodes by the thickening of the large crowded cup-shaped persistent woody bases of the leaves, and covered with thin creamy white bark becoming dark or ashy gray in their third year. **Winter-buds** with linear acute apiculate scales becoming woody, and persistent for one or two years. **Bark** of the trunk about ⅛′ thick, light brown tinged with red, and irregularly divided into large thin scales. **Wood** heavy, hard, very close-grained, thin, light brown or orange color, with lighter colored sapwood.

Distribution. Florida, only near the shores of Bay Biscayne on rich hummocks; common

on the shores of many of the Antilles, and southward to southern Mexico, the Pacific coast of the Isthmus of Panama, and to Venezuela.

B. Ovary inferior (*partly superior in Caprifoliaceæ*).

LXV. RUBIACEÆ.

Trees or shrubs, with watery juice, and opposite simple entire leaves turning black in drying, with stipules. Flowers regular, perfect; calyx-tube adnate to the ovary, its limb 4 or 5-lobed or toothed; corolla 4 or 5-lobed; stamens inserted on the tube of the corolla, as many as and alternate with its lobes; filaments free, or united at base; anthers introrse, 2-celled, the cells opening longitudinally; disk epigynous, annular; ovary inferior; style slender; ovules numerous, or 1 in each cell; raphe ventral; micropyle superior. Fruit capsular, akene-like, or drupaceous. Seeds with albumen; seed-coat membranaceous.

The Madder family with some three hundred and fifty genera is chiefly tropical, with a few herbaceous genera confined exclusively to temperate regions. To this family belong the Coffee, the Cinchonas, South American trees yielding quinine from their bark, and the plant which produces ipecacuanha, a species of Cephaelis and a native of Brazil, the Gardenia and other plants cultivated for their fragrant flowers.

CONSPECTUS OF THE ARBORESCENT GENERA OF THE UNITED STATES.

Fruit a capsule; seeds numerous, surrounded by a wing; parts of the flower in 5's.

Calyx 5-lobed, the lobes unequal, sometimes developing into rose-colored leaf-like bodies: filaments free; wing of the seed broad, oblong-ovate, unsymmetric on the sides; leaves deciduous. **1. Pinckneya.**

Calyx 5-toothed; filaments united into a short tube; wing of the seed narrow, symmetric; leaves persistent. **2. Exostema.**

Fruit akene-like, 1 or 2-seeded; parts of the flower in 4's or rarely in 5's, flowers in pedunculate globose heads; leaves deciduous. **3. Cephalanthus.**

Fruit drupaceous, with a 4-celled stone; parts of the flower in 4's; leaves persistent. **4. Guettarda.**

1. PINCKNEYA Michx.

A tree, with fibrous roots, scaly light brown bitter bark, resinous scaly buds, stout terete pithy branchlets coated while young with hoary tomentum, becoming glabrous, and marked by scattered minute white lenticels and large nearly orbicular or obcordate leaf-scars displaying a lunate row of numerous crowded fibro-vascular bundle-scars. Leaves complanate in the bud, elliptic to oblong-ovate, acute at apex, cuneate at base, and gradually narrowed into a long stout petiole, thin, coated at first with pale pubescence, and at maturity dark green and puberulous above, paler and puberulous below, especially along the stout midrib and primary veins, deciduous; stipules interpetiolar, conspicuously glandular-punctate at base on the inner face, inclosing the leaf in the bud, triangular, subulate, pink, becoming oblong, acute, scarious, light brown, caducous. Flowers in pedunculate terminal and axillary pubescent trichotomous few-flowered cymes, with linear-lanceolate acute bracts and bractlets at first pink, becoming scarious, deciduous, or sometimes enlarging and rose-colored; flower-buds sulcate, coated with thick pale tomentum; calyx-tube clavate, bracteolate at base, covered with hoary tomentum, not closed in the bud, the limb 5-lobed, with subulate-lanceolate lobes green tinged with pink, scarious, or in the central flower of the ultimate division of the cyme with 1 or rarely with 2 of the lobes produced into oval or ovate acute rose-colored puberulous membranaceous leaf-like bodies, deciduous; corolla salver-form, light yellow, cinereo-tomentose, with a long narrow tube somewhat enlarged in the throat, 5-lobed, the lobes valvate in the bud, oblong, obtuse, marked by red lines and pilose with long white hairs on the inner surface, recurved after anthesis; stamens exserted; filaments filiform, free; anthers oblong, emarginate; ovary 2-celled; style

filiform, exserted, slightly enlarged, 2-lobed and stigmatic at apex; ovules numerous, inserted in 2 ranks on a thin 2-lipped placenta longitudinally adnate to the inner face of the cell. Fruit a subglobose obscurely 2-lobed 2-celled capsule, loculicidally 2-valved, the valves thin and papery, light brown, puberulous, especially at the base, faintly rayed, marked by oblong pale spots and by the scars left by the falling of the deciduous calyx-limb and style, sometimes tardily septicidally 2-parted to the middle, persistent on the branches during the winter, the valves finally falling from the woody axis, their outer layer very thin, brittle, separable from the slightly thicker tough woody inner layer. Seeds horizontal, 2-ranked, minute, compressed; seed-coat thin, light brown, reticulate-veined, produced into a broad thin oblong-ovate wing, unsymmetrical on the sides, acute at apex, and longer above than below the seed; embryo elongated, immersed in the thick fleshy albumen; cotyledons ovate-oblong, foliaceous, longer than the terete radicle turned toward the hilum.

The genus is represented by a single species of the southeastern United States.

The generic name is in honor of Charles Cotesworth Pinckney (1746–1825) of South Carolina, the Revolutionary patriot.

1. Pinckneya pubens Michx. Georgia Bark.

Leaves unfolding in March, 5′–8′ long, 3′–4′ wide; petioles $\frac{3}{4}$′–$1\frac{1}{2}$′ in length. **Flowers** $1\frac{1}{2}$′ long appearing late in May and early in June, in open clusters 7′–8′ across, their petaloid

Fig. 771

calyx-lobes sometimes $2\frac{1}{2}$′ long and $\frac{1}{2}$′ wide. **Fruit** ripening in the autumn 1′ long and $\frac{2}{3}$′ wide; **seeds** with their wings about $\frac{1}{2}$′ long and $\frac{1}{3}$′ wide.

A tree, 20°–30° high, with a trunk occasionally 8′–10′ in diameter, slender spreading branches forming usually a narrow round-topped head, and branchlets coated when they first appear with hoary tomentum soon turning light red-brown, pubescent during the summer, and slightly puberulous during their first winter, ultimately becoming glabrous. **Winter-buds**: terminal ovoid, terete, $\frac{1}{2}$′ long, contracted above the middle into a slender point, and covered by the dark red-brown lanceolate acute stipules of the last pair of leaves of the previous year, often persistent at the base of the growing shoots and marked at the base by 2 broadly ovate pale scar-like slightly pilose elevations; axillary buds obtuse, minute, nearly immersed in the bark. **Bark** of the trunk about $\frac{1}{4}$′ thick, with a light brown surface divided into minute appressed scales. **Wood** close-grained, soft, weak, brown, with lighter-colored sapwood of 8–10 layers of annual growth. The bark has been used in the treatment of intermittent fevers.

Distribution. Low wet sandy swamps on the borders of streams; coast region of South Carolina through southern Georgia and northern Florida from Leon to Washington County; rare and local.

2. EXOSTEMA Rich.

Trees or shrubs, with terete branchlets, and bitter bark. Leaves sessile or petiolate, persistent; stipules interpetiolar, deciduous. Flowers axillary and solitary or in terminal pedunculate cymes, fragrant, the peduncle bibracteolate above the middle; calyx-tube ovoid, clavate or turbinate, the limb short, 5-lobed, the lobes nearly triangular, persistent; corolla 5-lobed, white, salver-form, the tube long and narrow, erect, the lobes of the limb linear, elongated, spreading, imbricated in the bud; filaments filiform, exserted, united at base into a tube inserted on and adnate to the tube of the corolla; anthers oblong-linear; ovary 2-celled; style elongated, slender, exserted; stigma capitate, simple or minutely 2-lobed; ovules numerous, attached on the 2 sides of a fleshy oblong peltate placenta fixed to the inner face of the cell, ascending. Fruit a many-seeded 2-celled capsule septicidally 2-valved, the valves 2-parted, their outer layer membranaceous, separable from the crustaceous inner layer. Seeds compressed, oblong, imbricated downward on the placenta; seed-coat chestnut-brown, lustrous, produced into a narrow wing; embryo minute, in fleshy albumen; cotyledons flat; radicle terete, inferior.

Exostema with about twenty species is confined to the tropics of America, and is most abundant in the Antilles, one species reaching the shores of southern Florida. The bark contains active tonic properties, and has been used as a febrifuge.

The generic name, from ἔξω and στῆμα, relates to the long exserted stamens.

1. Exostema caribæum R. & S. Prince Wood.

Leaves oblong-ovate to lanceolate, contracted into a slender point and apiculate at apex, gradually narrowed and cuneate at base, entire, thick and coriaceous, dark green on the upper surface and yellow-green on the lower surface, $1\frac{1}{2}'$–$3'$ long and $\frac{1}{2}'$–$1\frac{1}{4}'$ wide, with a prominent orange-colored midrib and conspicuous reticulate veinlets; unfolding in the autumn and in early spring and summer, and persistent for 1 or 2 years; petioles slender,

Fig. 772

orange-colored, $\frac{1}{4}'$–$\frac{1}{2}'$ in length; stipules nearly triangular, apiculate, with entire dentate or ciliate margins, about $\frac{1}{16}'$ long, and in falling marking the branchlets with ring-like scars. **Flowers** axillary, solitary, appearing from March until June, about $3'$ long, on slender pedicels spirally twisted before the flowers open; calyx-tube ovoid; corolla glabrous; filaments united into a short tube. **Fruit** $\frac{2}{3}'$ long, becoming black in drying; **seeds** oblong, $\frac{1}{8}'$ long, with a dark brown papillose coat and a light brown wing.

A glabrous tree, in Florida sometimes 20°–25° high, with a trunk 10′–12′ in diameter, slender erect branches forming a narrow head, and terete branchlets dark green at first, soon becoming dark red-brown and covered with pale lenticels, and in their second year ashy gray and conspicuously marked by the elevated leaf-scars. **Bark** of the trunk about $\frac{1}{8}$′ thick, and divided by deep fissures into square smooth pale or nearly white plates. **Wood** very heavy, exceedingly hard, strong, close-grained, light brown handsomely streaked with different shades of yellow and brown, with bright yellow sapwood of 12–20 layers of annual growth.

Distribution. Florida, shores of Bay Biscayne and on the Everglade Keys, Dade County, and on the southern keys; abundant on Key West and Upper Metacombe Key: on many of the Antilles, in southern Mexico, and on the west coast of Nicaragua.

3. CEPHALANTHUS L.

Small trees or shrubs, with opposite or verticillate petiolate leaves, interpetiolar stipules, and scaly buds. Flowers nectariferous, yellow or creamy white, sessile in the axils of glandular bracts, in dense globose pedunculate terminal or axillary solitary or panicled heads; receptacle globose, setose; calyx-tube obpyramidal, with a short limb unequally 4 or 5-toothed or lobed; corolla tubular salver-form, divided into 4 or 5 short spreading or reflexed lobes usually furnished with a minute dark gland at the base or on the side of each sinus, puberulous on the inner surface of the tube, the lobes imbricated in the bud; stamens inserted on the throat of the corolla; filaments short; anthers linear-oblong, sagittate, apiculate at base; pistil of 2 carpels; ovary 2-celled; style filiform, elongated; stigma clavate, entire; ovule solitary in each cell, suspended from the apex of the cell on a short papillose funicle, anatropous. Fruit obpyramidal, coriaceous, 2-coccous. Seeds oblong, pendulous, covered at apex by a white spongy aril; embryo straight in cartilaginous albumen; cotyledons oblong, obtuse; radicle elongated, superior.

Cephalanthus with seven species is widely distributed in North and South America, and in southern and eastern Asia, and the Malay Archipelago.

The generic name, from κεφαλή and ἄνθος, relates to the capitate inflorescence.

1. Cephalanthus occidentalis L. Button Bush.

Leaves ovate, lanceolate or elliptic, acute, acuminate or short-pointed at apex, rounded or cuneate at base, thin, dark green on the upper surface, paler and glabrous or puberulous on the lower surface, 2′–7′ long and $\frac{1}{2}$′–3$\frac{1}{2}$′ wide, with a stout light yellow midrib often covered below with long white hairs and 5 or 6 pairs of slender primary veins nearly parallel with the sides of the leaf; deciduous, or persistent during the winter; petioles stout, grooved, glabrous, $\frac{1}{2}$′–$\frac{3}{4}$′ in length; stipules minute, nearly triangular. **Flowers**: flower-heads 1′–1$\frac{1}{2}$′ in diameter on slender peduncles 1′–2′ long, usually in panicles 4′–5′ in length, their lower peduncles from the axil of upper leaves; flowers creamy white, very fragrant, opening from the middle of May in Florida and Texas to the middle of August in Canada and on the mountains of California; calyx usually 4 or occasionally 5-lobed, with short rounded lobes, and slightly villose toward the base; corolla glandular or eglandular; anthers nearly sessile, included, discharging their pollen before the flowers open; disk thin and obscure. **Fruit** ripening late in the autumn in heads $\frac{5}{8}$′–$\frac{3}{4}$′ in diameter, green tinged with red and ultimately dark red-brown.

A tree, occasionally 40°–50° high, with a straight tapering trunk a foot in diameter, and frequently free of limbs for 15°–20°, ascending and spreading branches, and stout branchlets with a thick pith, glabrous and marked by large oblong pale lenticels, and developed mostly in verticels of 3's from the axillary buds of one of the upper nodes, without a terminal bud, light green when they first appear, pale reddish brown, covered with a glaucous bloom during their first winter and then marked by small semicircular leaf-scars displaying semilunate fibro-vascular bundle-scars, and connected by the persistent black stipules or by their subulate scars, darker the following season, and dark brown in their third year, the bark then beginning to separate into the large loose scales found on the large branches and

on the stems of small plants; usually a shrub, only a few feet high. **Winter-buds** axillary, single or in pairs or in 3's one above the other, minute, nearly immersed in the bark. **Bark**

Fig. 773

of large trunks dark gray-brown or often nearly black, divided by deep fissures into broad flat ridges broken on the surface into elongated narrow scales. The bark contains tannin, and has been used in the treatment of fevers and in homœopathic practice.

Distribution. Swamps and the low wet borders of ponds and streams; New Brunswick to Ontario, southern Michigan, southern Minnesota, eastern Nebraska, Kansas and western Oklahoma (near Canton, Blaine County), southward to the shores of Bay Biscayne and the Everglade Keys, Dade County, Florida, eastern Texas to the valley of the Rio Grande, southern New Mexico, and Arizona, and widely distributed in California; in Mexico and Cuba; very rarely arborescent at the north and of its largest size on the margins of river-bottoms and swamps and in pond holes in southern Arkansas and eastern Texas; ascending on the southern Appalachian Mountains to altitudes of 2500°; passing into var. *pubescens* Rafn, with leaves soft pubescent below especially on the midrib and veins, and pubescent petioles, inflorescence and branchlets; southern Indiana, southeastern Missouri, southern Arkansas, western Louisiana and eastern Texas to the valley of the lower Brazos River.

Occasionally cultivated in the northeastern states as an ornamental plant.

4. GUETTARDA Endl.

Small trees or shrubs, with bitter bark, opposite or rarely verticellate persistent leaves, interpetiolar deciduous stipules, and scaly buds. Flowers sessile or short-pedicellate, with or without bractlets, in axillary forked pedunculate cymes, their bracts and bractlets lanceolate, acute, minute, deciduous; calyx globose, the limb produced above the ovary into an elongated 4–7-lobed tube; corolla salver-shaped, with an elongated cylindric tube naked in the throat, and a 4-lobed limb, the oblong lobes imbricated in the bud; stamens included; filaments free, short; anthers oblong-linear; ovary 4-celled, the cells elongated, tubular; style stout; stigma capitate; ovule solitary, suspended on the thickened funicle from the inner angle of the cell. Fruit a fleshy 1-stoned 2–9-seeded subglobose drupe, with thin flesh, and a bony or ligneous globose 4–9-celled stone obtusely angled or sulcate, the cells narrow and often curved upward. Seed compressed, suspended on the thick funicle closing the orifice of the wall of the stone, straight or excurved; albumen thin and fleshy; embryo elongated, cylindric or compressed; cotyledons flat, minute, not longer than the elongated terete radicle turned toward the hilum.

Guettarda with about fifty species is chiefly tropical American, with one species widely distributed on maritime shores from east tropical Africa to Australia and the islands of the Pacific Ocean. Of the species found within the territory of the United States two are arborescent. The bark of some of the species is occasionally employed as a tonic and febrifuge, and a few species are cultivated in tropical gardens for the delightful fragrance of their white flowers.

The generic name is in honor of Jean Étienne Guettard (1715–1786), the distinguished French botanist and mineralogist.

CONSPECTUS OF THE ARBORESCENT SPECIES OF THE UNITED STATES.

Leaves thin, pilose or glabrate above. 1. G. elliptica (D).
Leaves coriaceous, hispidulose-papillose and scabrate above. 2. G. scabra (D).

1. Guettarda elliptica Sw.

Leaves broad-oval to oblong-elliptic, acute or obtuse and apiculate at apex, and cuneate or rounded at base, covered with pale silky hairs when they unfold, and at maturity thin, dark green, pilose or glabrate on the upper surface, lighter colored and pubescent on the lower surface, especially along the stout midrib and in the axils of the 4–6 pairs of primary veins, $\frac{3}{4}'$–$2\frac{1}{2}'$ long and $\frac{1}{2}'$–$1'$ wide; unfolding in Florida in May and June and persistent on the branches until the trees begin their growth the following year; petioles stout, hairy,

Fig. 774

$\frac{1}{4}'$–$\frac{1}{2}'$ in length. **Flowers** pedicellate, appearing in Florida in June, yellowish white, $\frac{1}{4}'$ long, in slender hairy-stemmed cymes from the axils of leaves of the year near the end of branches, or from bud-scales at base of young shoots, their peduncle shorter than the leaves, forked near the apex, often with a flower in the fork and 3 at the end of each branch, or the lateral flowers of these clusters replaced by branches producing 3 flowers at their apex, the bractlets subtending the branches of the peduncle, and the lateral flowers of the ultimate divisions of the inflorescence linear-lanceolate, acute, coated with hairs, about $\frac{1}{16}'$ long, deciduous; calyx-lobes nearly triangular, acute, coated on the outer surface with long pale hairs, and half as long as the erect corolla canescent externally, with rounded lobes. **Fruit** ripening in November, dark purple, pilose, $\frac{1}{3}'$ in diameter, crowned with the remnants of the persistent calyx-tube, the flesh sweet and mealy; stone obscurely ridged and usually 2–4-seeded; **seeds** oblong-lanceolate, compressed, nearly straight, with a thin pale coat.

A slender tree, in Florida in hammocks occasionally 18°–20° high, with an irregularly

buttressed or lobed trunk 5′–6′ in diameter, the deep depressions between the lobes continuous or often interrupted, small upright branches, and thin terete branchlets coated when they first appear with long pale or rufous hairs and light red-brown or ashy gray and conspicuously marked by pale lenticels, and in their second year by large elevated orbicular leaf-scars; or often a shrub. **Winter-buds** acuminate, light brown, coated with pale pubescence, and about $\frac{1}{8}$′ long. **Bark** of the trunk about $\frac{1}{16}$′ thick, with a smooth dark brown surface covered with large irregularly shaped pale blotches and numerous small white spots. **Wood** heavy, hard, very close-grained, light brown tinged with red, with thin sapwood of 6–10 layers of annual growth.

Distribution. Florida, on the Everglade Keys (Royal Palm Hammock), and coast of the southern keys; on the Bahama Islands and in Jamaica.

2. Guettarda scabra Lam.

Leaves oval, oblong or ovate, acuminate or rounded and apiculate at apex, gradually narrowed or broad at the rounded or subcordate base, entire, coriaceous, dark green, hispidulose-papillose and scabrate on the upper surface, pale and soft-pubescent on the lower surface, 2′–5′ long and $1\frac{1}{4}$′–$3\frac{1}{4}$′ wide, with thickened slightly revolute margins, a stout midrib, usually 8–11 pairs of prominent primary veins and conspicuous reticulate veinlets;

Fig. 775

petioles stout, rusty-pubescent, $\frac{1}{3}$′–$\frac{3}{4}$′ in length; stipules concave at base, gradually narrowed above into a long slender point, pubescent, as long as the petioles. **Flowers** produced irregularly during the winter and early spring, sessile or short-pedicellate in the axils of acute bracts, in pedunculate cymes on slender rusty-pubescent peduncles $1\frac{1}{2}$′–2′ in length; calyx short-oblong, densely pubescent on the outer surface; corolla often 1′ in length, the slender tube retrorsely silky-villose on the outer surface, the lobes 5–7, usually 5, oblong-obtuse; filaments free, short; anthers oblong-linear, included, style shorter than the tube of the corolla; stigma capitate. **Fruit** ripening in the autumn, subglobose, pubescent, $\frac{1}{4}$′ in diameter, and crowned by the persistent tube of the calyx; flesh thin and dry; **stone slightly angled thick-walled, 4–9-seeded.**

A tree, in Florida sometimes 20°–25° high, with a tall trunk 2′–$2\frac{1}{2}$′ in diameter, small ascending branches forming an open irregular head, and stout or slender branchlets densely covered during their first season with rufous pubescence, and light reddish brown, slightly pubescent and marked by conspicuous leaf-scars in their second year; often a shrub.

Distribution. Florida, near Miami and on the Everglade Keys, Dade County, and on the southern keys; on the Bahama Islands and on several of the Antilles.

LXVI. CAPRIFOLIACEÆ.

Trees or shrubs, with watery juice, opposite petiolate leaves involute in the bud, with or without stipules, scaly buds, and fibrous roots. Flowers regular, perfect, with articulated pedicels, in terminal compound cymes; calyx-tube adnate to the ovary, 5-toothed; corolla epigynous, 5-lobed, the lobes imbricated in the bud; stamens 5, inserted on the tube of the corolla, as many as and alternate with its lobes; filaments slender, free; anthers oblong, introrse, 2-celled, the cells opening longitudinally; disk 0 (in the arborescent genera of the United States); ovary inferior or partly superior, 3–5 or 1-celled; style short, capitate, 3–5-lobed and stigmatic at apex; ovule solitary, suspended from the apex of the cell, resupinate; raphe dorsal; micropyle superior. Fruit drupaceous, crowned with the remnants of the style. Seeds with copious fleshy albumen; seed-coat membranaceous, adherent to the albumen; embryo minute, near the hilum; cotyledons ovoid or ovate; radicle terete, erect.

The Honeysuckle family with ten genera is most abundant in the temperate regions of the northern hemisphere, with a few species extending into the tropics and to beyond the tropics in the southern hemisphere. Many of the species, especially of Lonicera, Sambucus, and Viburnum, are cultivated in gardens for the beauty of their flowers and fruits.

CONSPECTUS OF THE ARBORESCENT GENERA OF THE UNITED STATES.

Leaves unequally pinnate; fruit with 3–5 nutlets. 1. Sambucus.
Leaves simple; fruit with 1 stone. 2. Viburnum.

1. SAMBUCUS L. Elder.

Trees or shrubs, with stout branches containing thick white or brown pith, and buds with several scales. Leaves petiolate, unequally pinnate, deciduous, with serrate or laciniate leaflets, the base of the petiole naked, glandular or furnished with a stipule-like leaflet; stipels small, leaf-like, usually setaceous, often 0; stipules small, rudimentary, usually 0 except on vigorous shoots. Flowers small, in broad terminal corymbose cymes, their bracts and bractlets lanceolate, acute, scarious, caducous, sometimes ebracteolate; calyx-tube ovoid, the limb 3–5-lobed or toothed; corolla rotate or slightly campanulate, equally 3–5-parted; filaments filiform or subulate; ovary inferior or partly superior, 3–5-celled; style abbreviated, thick and conic, 3–5-lobed, stigmatic at apex. Fruit subglobose, with juicy flesh, and 3–5 oblong cartilaginous punctate-rugulose or smooth 1-seeded nutlets full and rounded on the back and rounded at the ends. Seeds filling the cavity of the nutlets, pale brown; cotyledons ovoid.

Sambucus with about twenty species is widely and generally distributed through the temperate parts of North America, Europe, and Asia, and inhabits high mountain ranges within the tropics, and in Australia, Tasmania, and New Zealand. Of the nine or ten North American species three are arborescent. Sambucus possesses cathartic and emetic properties in the bark; the flowers are excitant and sudorific, and the juice of the fruit is alterative and laxative. The dried flowers of the European *Sambucus nigra* L., are used in the preparation of an aromatic distilled water and in flavoring lard, and the hard and compact wood is made into combs and mathematical instruments. The large pithy shoots of Sambucus furnish children with pop-guns, pipes, and whistles; and the fruit of some of the species is cooked and eaten.

Sambucus, the name of the Elder-tree, is believed to have been derived from σαμβύκη, a musical instrument, probably in allusion to the use of the pithy stems.

CONSPECTUS OF THE ARBORESCENT SPECIES OF THE UNITED STATES.

Cymes flat-topped; pith usually white; fruit black; nutlets rugose.
Fruit lustrous. 1. **S. Simpsonii** (C).
Fruit appearing blue from a thick covering of bloom. 2. **S. coerulea** (B, F, G, H).
Cymes ovoid; pith pale brown; fruit red; nutlets smooth. 3. **S. callicarpa** (B, G).

1. Sambucus Simpsonii Rehd.

Sambucus intermedia Small, not Carrière.

Leaves 4′–7′ long, 3–7, usually 5-foliolulate, with a glabrous petiole and usually 5 dark yellow-green leaflets, frequently deciduous, lustrous and glabrous on the upper surface with the exception of a few scattered hairs on the midrib, and paler and glabrous on the lower surface, the terminal leaflet obovate or oblong-obovate, short-acuminate at apex, and gradually narrowed at base into a slender petiolule $\frac{1}{3}$′–$\frac{1}{2}$′ in length, the lateral leaflets broad-

Fig. 776

elliptic to oblong-elliptic, short-acuminate, broad-cuneate at base, those of the upper pair usually sessile, those of the lower pair on short stalks rarely more than $1\frac{1}{2}$′ long, serrate except at the base with small slightly spreading teeth, $1\frac{1}{2}$′–3′ long and $1\frac{1}{2}$′–$2\frac{1}{2}$′ wide. **Flowers** slightly fragrant, on slender pedicels in convex or sometimes flat cymes 3′–8′ in diameter, with 4 or 5 rays, the terminal ray as long or longer than the lateral rays, rarely shorter; calyx-tube ovoid, the lobes oblong-ovate, acute, about as long as the tube and slightly exceeding the thick conic style; stamens about as long as the white corolla-lobes; ovary usually 5, rarely 4-celled. **Fruit** subglobose, dark purplish black, about $\frac{1}{4}$′ in diameter; nutlets rugose.

A tree, sometimes 15°–18° high, with a trunk often 8′ in diameter, and slightly angled branchlets greenish when they first appear, becoming light yellow-gray and sometimes covered during their second and third years with thick corky excrescences; pith white, on 2 or 3-year-old branches comparatively narrow, occupying only about one-third of the diameter of the stem.

Distribution. Florida, neighborhood of Jacksonville, Duval County, to Eustis, Lake County, Bradentown, Manatee County, and Sanibel Island, Lee County; Mississippi, Ocean Springs, Jackson County; Louisiana, Cameron, Cameron Parish.

2. Sambucus coerulea Raf.

Sambucus glauca Nutt.

Sambucus neomexicana Woot.

Leaves 5′–7′ long, with a stout grooved petiole much enlarged and naked or sometimes furnished at the base with leaf-like appendages, and 5–9 ovate or narrow-oblong leaflets contracted at apex into a long point, unequally cuneate or rounded at base, and coarsely

serrate with spreading or slightly incurved callous-tipped teeth, the lower leaflets often 3-parted or pinnate, the terminal one sometimes furnished with 1 or 2 lateral stalked leaflets, yellow-green on the upper surface, pale on the lower surface, covered with scattered pale hairs when they unfold, and at maturity glabrous or soft pubescent beneath (var. *velutina* Rehd.), thin, rather firm in texture, bright green above and pale below, 1′–6′ long and $\frac{1}{3}$′–$1\frac{1}{2}$′ wide, with a narrow pale midrib and inconspicuous veins; petiolules slender, those of the lateral leaflets $\frac{1}{4}$′–$\frac{1}{2}$′ and of the terminal leaflet up to 2′ in length; stipels linear, oblong-lanceolate to ovate, rounded or acute at apex, entire or sharply serrate and leaf-like, $\frac{1}{16}$′–$\frac{1}{2}$′ long, caducous, often 0. **Flowers** $\frac{1}{8}$′ in diameter, appearing from April in southern

Fig. 777

California to July in British Columbia, in flat long-branched glabrous or pubescent cymes 4′–10′ wide, with linear acute green caducous bracts and bractlets, the lower branches often from the axils of upper leaves; flower-buds globose, covered with a glaucous bloom, sometimes turning red before opening; calyx ovoid, red-brown, with acute scarious lobes; corolla yellowish white, with oblong divisions rounded at apex, as long as the stamens. **Fruit** subglobose, $\frac{1}{3}$′ in diameter, black, appearing blue by its thick covering of mealy bloom; flesh rather sweet and juicy.

A tree, 30°–50° high, with a tall straight trunk sometimes enlarged at base and 12′–18′ in diameter, stout spreading branches forming a compact round-topped head, and branchlets usually without a terminal bud, green tinged with red or brown when they first appear, and covered with short white caducous hairs, or densely soft pubescent during their first season (var. *velutina* Rehd.), stout, slightly angled, covered with lustrous red-brown bark in their first winter and nearly encircled by the large triangular leaf-scars marked by conspicuous fibro-vascular bundle-scars; pith white or rarely brownish; often a broad shrub, with numerous spreading stems. **Winter-buds** axillary generally in pairs, superposed or in clusters of 4 or 5, only the upper bud or sometimes the lower usually developing, covered with 2 or 3 pairs of opposite broad-ovate chestnut-brown scales, those of the inner rank accrescent, and at maturity acute, entire, green, 1′ long, and sometimes developing into pinnate leaves 2′–3′ in length. **Bark** of the trunk deeply and irregularly fissured, the dark brown surface slightly tinged with red and broken into small square appressed scales. **Wood** light, soft, weak, coarse-grained, yellow tinged with brown, with thin lighter colored sapwood.

Distribution. Gravelly rather dry soil of valleys and river-bottoms; western Montana (neighborhood of Flathead Lake and Missoula, Missoula County), through Idaho to the coast of British Columbia (Vancouver Island), and southward to the San Bernardino

Mountains and Santa Catalina Island, California, ascending on the Cascade and Sierra Nevada Mountains to altitudes of 6000°–8000°; Nevada, King's Cañon, Ormsby County; Utah, Juab, Juab County, and the neighborhood of Salt Lake City, Salt Lake County; Colorado, near Trinidad, Las Animas County; New Mexico, Sacramento Mountains, Otero County; very abundant in the coast region; comparatively rare in the interior; of its largest size in the valleys of western Oregon; northward, and east of the Cascade and Sierra Nevada Mountains rarely arborescent; in southern California often with smaller leaves and flower-clusters than northward; the var. *velutina* rare and local, California, Goose Valley, Shasta County; at altitudes of 6000°–7000° on the Sierra Nevada in Sierra, Madera and Kern Counties, and on Santa Catalina Island; Nevada, on Hunter's Creek, Washoe County, at an altitude of 6000°.

Occasionally planted as an ornamental plant in the Pacific states, passing into

Sambucus coerulea var. arizonica Sarg.

Sambucus mexicana Sarg., not Presl.

Differing from *Sambucus coerulea* in its 3–5, usually 3-foliate leaves with usually elliptic long-acuminate leaflets glabrous or slightly pubescent when they appear, 1′–3′ long and ½′–1′ wide, their stipels minute or rudimentary, smaller flower-clusters and fruit not more than ¼′ in diameter.

A tree, often 30° high, with stout spreading branches forming a compact round-topped head, and slender branchlets glabrous or villose pubescent early in the season, usually be-

Fig. 778

coming glabrous. Bark of the trunk about ¼′ thick, the light brown surface tinged with red and broken into long narrow horizontal ridge-like scales. Wood light, soft, close-grained, light brown, with thin lighter-colored sapwood of 2 or 3 layers of annual growth.

Distribution. Banks of streams; Arizona, Grand View Trail, Grand Cañon of the Colorado River and near Flagstaff, Coconino County, Globe, Gila County, and banks of the Rialta near Tucson, Pima County; common; New Mexico, near Silver City, Grant County; southern California (San Diego, Los Angeles, Ventura and Kern Counties).

3. Sambucus callicarpa Greene.

Leaves 6′–10′ long, with a stout slightly grooved petiole and 5–7, usually 5, elliptic finely or coarsely serrate leaflets, acuminate and long-pointed at apex, cuneate and often unsymmetric at base, dark green and glabrous on the upper surface, paler and more or less villose-pubescent on the lower surface, especially along the slender midrib, 2½′–5′ long and ½′–2′

wide; petiolules $\frac{1}{8}'$–$\frac{1}{4}'$ or that of the terminal leaflet up to $1\frac{1}{2}'$ in length. **Flowers** on pedicels $\frac{1}{8}'$ long, in ovoid to semiorbicular cymes, usually $2\frac{1}{2}'$–$3'$ long and broad, often somewhat flattened at maturity, on stout peduncles $1\frac{1}{2}'$–$3'$ in length, about $\frac{1}{3}'$ in diameter, with white

Fig. 779

or yellow slightly obovate petals rounded at apex, and stamens rather shorter than the lobes of the corolla. **Fruit** about $\frac{1}{2}'$ in diameter, bright red or rarely chestnut color (f. *Piperi* Sarg.); nutlets smooth.

A tree, occasionally 25°–30° high, with a trunk 10′–12′ in diameter, slender branchlets occasionally puberulous early in the season, becoming glabrous, light brown, separating on the surface into thin scales.

Distribution. River banks in low moist soil, from sea-level in the neighborhood of the coast up to altitudes of 7000°–8000°; coast of Alaska (Skagway), southward along the coast to Marin County, California, and inland to the western slopes of the Cascade and Sierra Nevada Mountains, southward to Amador County; the f. *Piperi* in western Washington.

2. VIBURNUM A. L. de Juss.

Trees or shrubs, with tough flexible branchlets, and large winter-buds naked or covered with scales, those of the arborescent North American species enclosed in one pair of valvate scales, the buds containing flower-bearing branches ovoid, swollen below the middle and contracted into a long or short point and subtended by 2 minute lateral generally abortive buds formed in the axils of the last leaves of the previous year, those containing sterile shoots narrow-lanceolate, slightly angled, acute; axillary buds acute, much flattened, and much smaller than the terminal bud. Leaves deciduous (in the American species), without or rarely with stipules, the first pair rudimentary, with small blades and broad boat-shaped petioles, caducous (in the North American arborescent species). Flowers on short bracteolate or bibracteolate pedicels, in terminal or axillary umbel-like flat or panicled cymes, their bracts and bractlets minute, lanceolate, acute, caducous; calyx-tube cylindric, the limb short, equally 5-lobed, persistent on the fruit; corolla rotate, equally 5-lobed, spreading and reflexed after anthesis; stamens inserted on the base of the corolla; filaments elongated, exserted; anthers bright yellow; ovary inferior, 1-celled; style conic, divided at

apex into three stigmatic lobes. Fruit 1-celled, with thin sweet acidulous or oily flesh, stone (in the North American arborescent species) coriaceous, oval, short-pointed at apex; much flattened, dull reddish brown, slightly pitted. Seed filling the cavity of the stone, concave on the ventral face, bright reddish brown, the thin coat projected into a red narrow irregular often erose marginal border.

Viburnum with a hundred species is widely and generally distributed through the temperate regions of the northern hemisphere, and occurs on the mountains of central and western South America, on the Antilles, the islands of the Malay Archipelago, and Madagascar. Of the fifteen North American species four are small trees. Many of the species produce beautiful flowers and fruits, and are frequently cultivated as ornaments of parks and gardens.

Viburnum is the classical name of one of the European species.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT SPECIES.

Leaves entire or obscurely crenulate; inflorescence long-stalked; winter-buds elongated, narrow-lanceolate, acuminate, covered with rusty scales. **1. V. nudum** (A, C).

Leaves sharply serrate; inflorescence sessile or short-stalked.

Petioles wing-margined; inflorescence sessile; winter-buds long-pointed, scurfy pubescent. **2. V. Lentago** (A, C, F).

Petioles usually without margins.

Petioles nearly glabrous; inflorescence short-stalked; winter-buds short-pointed or obtuse, rufous pubescent. **3. V. prunifolium** (A, C).

Petioles of early leaves and the short-pointed winter-buds rusty tomentose, inflorescence sessile. **4. V. rufidulum** (A, C).

1. Viburnum nudum L.

Leaves broad-elliptic to oval or slightly obovate, or in one form narrow-elliptic (var. *angustifolium* Torr. & Gray), acute, acuminate or abruptly short-pointed or rarely rounded at apex, cuneate or rounded at base, entire or slightly crenulate, covered when they unfold

Fig. 780

with rusty scales persistent on the lower side of the midrib and petioles and occasionally on the whole lower surface, thick, dark green and lustrous on the upper surface, paler on the lower surface, 4′–6′ long and 1½′–2′ wide, with a prominent midrib, slender veins, and slightly thickened and revolute margins; very variable in the size and shape of the leaves and in the amount of their scurfy covering, those of the southern tree form usually larger than the leaves of more northern shrubs; leaves of the var. *angustifolium* often not more than 2′ long and ½′ wide; petioles slender, ½′ in length. **Flowers** appearing from the first of May at the

south to the middle of June at the north and occasionally also in the autumn, white or pale cream color, about $\frac{1}{4}'$ wide, in flat or slightly convex cymes with ovate acute bracts and bractlets, 2′–4′ in diameter and about as long or rather shorter than their peduncle. **Fruit** ripening late in the autumn, globose, pink at first when fully grown, becoming bright blue, $\frac{1}{4}'$ in diameter.

A tree, rarely 18′–20′ high, with a tall trunk 6′–8′ in diameter, with spreading nearly horizontal branches forming an open head, and slender branchlets scurfy when they first appear, soon becoming glabrous, reddish brown and lustrous during their first season and greenish brown the following year; usually a small or large shrub, and perhaps only a tree on the borders of swamps near Gainesville, Alachua County, and Palatka, Putnam County, Florida. **Winter-buds** reddish brown, covered with rusty scales, those containing flower-bearing branches, abruptly long pointed, $\frac{1}{2}'$–$\frac{3}{4}'$ in length.

Distribution. Low moist soil usually in the neighborhood of swamps and streams, and on rich hillsides; southern Connecticut (Milford and Derby, New Haven County), southward through the coast and Piedmont region, to De Soto County (near Sebring), Florida, and westward usually in the neighborhood of the coast to the valley of the lower Brazos River, eastern Texas, and northward through western Louisiana to central Arkansas and western Tennessee; occasionally ascending the Appalachian Mountains to altitudes of 2000°; the var. *angustifolium* from North Carolina up to altitudes of 3000° on the Blue Ridge, to northern Florida.

2. Viburnum Lentago L. Sheepberry. Nannyberry.

Leaves ovate, usually acuminate, with short or elongated points, or sometimes rounded at apex, cuneate, rounded or subcordate at base, and sharply serrate with incurved callous-tipped teeth, when they unfold bronze-green, lustrous, coated on both surfaces of the midrib and on the petioles with thick rufous pubescence, slightly pilose on the upper surface and covered on the lower with short pale hairs, and at maturity bright green and lustrous

Fig. 781

above, yellow-green and marked by minute black dots below, $2\frac{1}{2}'$–3′ long and 1′–$1\frac{1}{2}'$ wide, with a slender midrib, and primary veins connected by conspicuous reticulate veinlets; turning in the autumn before falling deep orange-red or red and orange color; petioles broad, grooved, more or less interruptedly winged or occasionally wingless, 1′–$1\frac{1}{2}'$ long, those of the first pair of leaves covered with thick rufous tomentum. **Flowers** about $\frac{1}{4}'$ in diameter, slightly fragrant, appearing from the middle of April to the 1st of June in stout-branched scurfy sessile slightly convex cymes 3′–5′ in diameter, with nearly triangular green cadu-

cous bracts and bractlets about $\frac{1}{10}'$ in length; corolla pale cream color or nearly white, with ovate lobes acute and slightly erose at apex. **Fruit** ripening in September on slender drooping stalks, in red-stemmed few-fruited clusters, oval or occasionally globose (var. *sphaerocarpum* A. Gray), thick-skinned, sweet and rather juicy, black or dark blue, and covered with a glaucous bloom; stone about $\frac{7}{8}'$ long and $\frac{5}{10}'$ wide.

A bushy tree, 20°–30° high, with a short trunk 8′–10′ in diameter, slender rather pendulous branches forming a compact round-topped head, and thin divergent branchlets light green, slightly covered with rufous pubescence when they first appear, and in their first winter light red, scurfy, marked by occasional dark orange-colored lenticels and by narrow leaf-scars displaying 3 conspicuous fibro-vascular bundle-scars, becoming in their second year dark reddish brown and sometimes covered with a glaucous bloom. **Winter-buds** light red, generally covered with pale scurfy pubescence, those containing flower-bearing branchlets $\frac{3}{4}'$ in length, abruptly contracted into long narrow tapering points. **Bark** of the trunk reddish brown and irregularly broken into small thick plates divided on their surface into minute thin appressed scales. **Wood** bad-smelling, heavy, hard, close-grained, dark orange-brown, with thin nearly white sapwood.

Distribution. Rocky hillsides, along the borders of forests, or near the banks of streams and the margins of swamps, in moist soil; valley of the Rivière du Loup, Province of Quebec, to Saskatchewan, and southward through the northern states to southern Pennsylvania, central Ohio, northern Indiana and southern Wisconsin, northeastern Iowa and eastern Nebraska, and along the Appalachian Mountains up to altitudes of 2500° to West Virginia; on the Turtle Mountains of North Dakota, the Black Hills of South Dakota, on the eastern foothills of the Bighorn Mountains of Wyoming and on those of the Rocky Mountains of Colorado (Boulder, Boulder County).

Often cultivated as an ornament of parks and gardens in the eastern United States, and occasionally in Europe.

× *Viburnum Jackii* Rehd. with characters intermediate between *Viburnum Lentago* and *V. prunifolium* is now believed to be a hybrid between those species.

3. Viburnum prunifolium L. Black Haw. Stag Bush.

Leaves ovate or rarely obovate, oval or suborbicular, rounded, acute, or short-pointed at apex, cuneate or rounded at base, and usually rather remotely or sometimes finely serrate with rigid incurved callous-tipped teeth, lustrous and tinged with red, glabrous on the lower surface and covered on the upper side of the midrib and on the bright red petioles with scattered reddish hairs when they unfold, and at maturity thick or sometimes coriaceous, dark green and glabrous on the upper surface, pale and glabrous on the lower surface, 1′–3′ long and $\frac{1}{2}'$–3′ wide, with slender primary veins connected by reticulate veinlets; in the autumn turning brilliant scarlet or dark vinous red before falling; petioles terete, grooved, $\frac{1}{2}'$–$\frac{2}{3}'$ in length, and on vigorous shoots sometimes narrowly wing-margined. **Flowers** $\frac{1}{4}'$ in diameter on slender pedicels bibracteolate at apex, in glabrous short-stemmed flat cymes 2′–4′ in diameter, with subulate caducous bracts about $\frac{1}{10}'$ long, usually red above the middle; corolla pure white, with oval to nearly orbicular lobes. **Fruit** ripening in October, in few-fruited red-stemmed clusters, persistent on the branches until the beginning of winter, oval or slightly obovoid, $\frac{1}{2}'$–$\frac{2}{3}'$ long or rarely globose, dark blue and covered with a glaucous bloom; stone about $\frac{1}{2}'$ long and $\frac{1}{3}'$ wide.

A bushy tree, occasionally 20°–30° high, with a short and usually crooked trunk 6′–8′ in diameter, stout spreading rigid branches beset with slender spine-like branchlets, bright red and glabrous when they first appear, soon turning green, and in their first winter gray tinged with red, covered with a slight bloom, and marked by orange-colored lenticels and by the large lunate leaf-scars displaying 3 fibro-vascular bundle-scars, and ultimately dark brown tinged with red; or often a low intricately branched shrub. **Winter-buds** short-pointed or obtuse, brown, glabrous or scurfy, those containing flower-bearing branches about $\frac{1}{2}'$ long and $\frac{1}{4}'$ wide, and about twice as large as those containing sterile branchlets. **Bark** of the trunk $\frac{1}{4}'$–$\frac{1}{3}'$ thick, and broken into thick irregularly shaped plate-like red-brown scales.

Wood heavy, hard, strong, brittle, close-grained, brown tinged with red, with thick nearly white sapwood of 20-30 layers of annual growth.

Distribution. Dry rocky hillsides, fence-rows and the sides of roads; Fairfield County, Connecticut, and the valley of the lower Hudson River, New York, southward to south-

Fig. 782

eastern Virginia and to the Coast and Piedmont regions of North and South Carolina up to altitudes of 2000° to the valley of the Savannah River (near Augusta, Georgia, Richmond County, rare), and through southern Ohio, to central Michigan, Indiana, southern Illinois, southern and western Kentucky, Missouri and eastern Kansas; very abundant in Missouri from the northeastern counties southward through the state.

Often cultivated as an ornament of parks and gardens in the eastern United States, and occasionally in western and northern Europe.

4. Viburnum rufidulum Raf. Black Haw.

Leaves elliptic to obovate or oval, rounded, acute, or short-pointed at apex, cuneate or rounded at base, and finely serrate with slender apiculate straight or incurved teeth, cov-

Fig. 783

ered below and on the wings of the petiole with thick ferrugineous tomentum when they unfold and at maturity coriaceous, dark green and very lustrous above, pale and dull be-

low, usually about 3′ long and $\frac{3}{4}$′–1$\frac{1}{2}$′ wide, with a stout yellow midrib, numerous slender primary veins, and reticulate veinlets more or less covered below throughout the season with rufous tomentum also occasionally found on the upper side of the midrib; petioles stout, grooved, $\frac{1}{2}$′–$\frac{3}{4}$′ long, and margined with broad or narrow wings. **Flowers** $\frac{1}{4}$′ in diameter, in sessile 3–5 but usually 4-rayed thick-stemmed ferrugineo-pubescent flat corymbs often 5′–6′ in diameter, with minute subulate bracts and bractlets; corolla creamy white, with orbicular or oblong rounded lobes. **Fruit** ripening in October, in few-fruited drooping red-stemmed clusters, short-oblong or slightly obovoid, bright blue covered with a glaucous bloom, and $\frac{1}{2}$′–$\frac{2}{3}$′ long; stone $\frac{1}{2}$′ long and about $\frac{1}{3}$′ wide.

A tree, often 40° high, with a trunk 12′–18′ in diameter, short thick branches forming an open irregular head, and stout branchlets marked by numerous small red-brown or orange lenticels, when they first appear more or less coated with ferrugineous tomentum, ashy gray during their first winter, and dark dull red-brown in their second season. **Winter-buds** ferrugineo-tomentose, those containing flower-bearing branchlets broad-ovoid, full and rounded at base, short-pointed and obtuse at apex, compressed, often $\frac{1}{2}$′ long and $\frac{1}{3}$′ wide, and rather larger than those containing sterile branchlets. **Bark** of the trunk $\frac{1}{4}$′–$\frac{1}{2}$′ thick, separating into narrow rounded ridges divided by numerous cross fissures, and roughened by small plate-like dark brown scales tinged with red. **Wood** bad-smelling.

Distribution. Dry upland woods and the margins of river-bottom lands; southwestern Virginia and southern Indiana and Illinois to Hernando County, Florida, and through the Gulf States to the valleys of the upper Guadalupe River and of Clear Creek, Brown County, Texas, and to eastern and southwestern Oklahoma (on the Wichita Mountains, Comanche County), eastern Kansas and Central Missouri; most abundant and of its largest size in southern Arkansas, western Louisiana, and eastern Texas.

Occasionally cultivated in the eastern states, and hardy as far north as eastern Massachusetts.

GLOSSARY OF TECHNICAL TERMS

Accrescent. Increasing in size with age.
Accumbent. Lying against, as the radicle against the edges of the cotyledons.
Acuminate. Gradually tapering to the apex.
Acute. Pointed.
Adnate. Congenitally united to.
Adventitious. Said of buds produced without order from any part of a stem.
Æstivation. The arrangement of the parts of a flower in the bud.
Akene or *achene.* A small dry and hard, 1-celled, 1-seeded, indehiscent fruit.
Albumen. The deposit of nutritive material within the coats of a seed and surrounding the embryo.
Ament. A unisexual spike of flowers with scaly bracts, usually deciduous in one piece.
Amphitropous. Descriptive of an ovule with the hilum intermediate between the micropyle and chalaza.
Anatropous. Descriptive of a reversed ovule, with the micropyle close by the side of the hilum, and chalaza at the opposite end.
Androdiœcious. With perfect flowers on one individual and staminate flowers only on another.
Androgynous. Applied to an inflorescence composed of male and female flowers.
Angiospermæ. Plants with seeds borne in a pericarp.
Annular. In the form of a ring.
Anterior. The front side of a flower, that is averse from the axis of inflorescence.
Anther. The part of the stamen containing the pollen.
Anthesis. The act of opening of a flower.
Apetalous. Having no petals.
Apex. The top, as the end of the leaf opposite the petiole.
Apiculate. Ending in a short pointed tip.
Apophysis. An enlargement or swelling of the surface of an organ.
Arcuate. Moderately curved.
Areolate. Marked by areolæ or spaces marked out on a surface.
Aril. An extraneous seed-coat or covering, or an appendage growing about the hilum of a seed.
Ariloid. Furnished with an aril.
Aristate. Furnished with awns.
Articulate. Jointed or having the appearance of a joint.
Auricled or *auriculate.* Furnished with an auricle or ear-shaped appendage.
Autocarpus. A fruit consisting of pericarp alone, without adherent parts.
Axil. The angle formed on the upper side of the attachment of a leaf with a stem.
Axillary. In or from an axil.

Bâccate. Berry-like.
Bark. The rind or cortical covering of a stem.
Berry. A fruit with a homogeneous fleshy pericarp.
Bipinnate. Doubly or twice pinnate.
Bract. The more or less modified leaf of a flower-cluster.
Bracteate. Furnished with bracts.
Bracteolate. Furnished with bractlets.
Bractlet. The bract of a pedicel or ultimate flower-stalk.
Branch. A secondary axis or division of a trunk.
Branchlet. An ultimate division of a branch.
Bud. The undeveloped state of a branch or flower-cluster with or without scales.
Bud-scales. Reduced leaves covering a bud.

Calyx. The flower-cup or exterior part of a perianth.
Campanulate. Bell-shaped, or elongated cup-shaped.
Campylotropous. Descriptive of an ovule or seed curved in its formation so as to bring the micropyle or apex down near the hilum.
Canescent. Hoary, with gray or whitish pubescence.
Capsule. A dry dehiscent fruit of more than one carpel.
Carpel. A simple pistil or an element of a compound pistil.
Catkin. The same as an ament.
Caudate. Furnished with a tail, or with a slender tip or appendage.
Centripetal. Developing from without toward the centre.
Chalaza. The part of an ovule where the coats and nucleus are confluent.
Chartaceous. Having the texture of paper.
Ciliate. Fringed with hairs.
Cinereous. Ashy gray.
Circinnate. Involute from the apex into a coil.
Circumscissile. Circularly and transversely dehiscent.
Clavate. Club-shaped.
Cocci. Portions into which a lobed fruit with 1-seeded cells splits up.
Cochleate. Shell-shaped, spiral like the shell of a snail.
Columella. The persistent axis of a capsule.
Commissure. The face by which 2 carpels unite.
Complanate. Flattened.
Conduplicate. Folded together lengthwise.
Cone. An inflorescence or fruit formed of imbricated scales.
Conferruminate. Stuck together by adjacent faces.
Connate. United congenitally.
Connective. The portion of a stamen which connects the two cells or lobes of an anther.
Contortuplicate. Twisted and plaited, or folded.
Convolute. Rolled up from the sides.
Cordate. Heart-shaped.
Coriaceous. Of the texture of leather.
Corymb. A flat-topped or convex open flower-cluster, the flowers opening from the outside inward.

Corymbose. Said of flowers arranged in a corymb.
Costate. Having ribs.
Cotyledons. The leaves of the embryo.
Crenate. Scalloped.
Crenulate. The diminutive of crenate.
Crispate. Curled.
Crustaceous. Of hard brittle texture.
Cucullate. Hooded or hood-shaped.
Cuneate. Wedge-shaped, or triangular with an acute angle downward.
Cyme. A flower-cluster, the flower opening from the centre outward.
Cymose. Bearing cymes or relating to a cyme.

Deciduous. Falling, said of leaves falling in the autumn, or of parts of a flower falling after anthesis.
Declinate. Bent or curved downward.
Decompound. Several times compound or divided.
Decurrent. Running down, as of the blades of leaves extending down their petioles.
Decussate. In pairs alternately crossing at right angles.
Dehiscent. The opening of an anther or capsule by slits or valves.
Deltoid. Having the shape of the Greek letter Δ.
Dentate. Toothed.
Denticulate. Minutely toothed.
Dextrorse. Turned or directed to the right.
Diadelphous Said of stamens combined by their filaments into 2 sets.
Dichotomous. Forked in pairs.
Digitate. Said of a compound leaf in which the leaflets are borne at the apex of the petiole.
Dimorphous. Said of flowers of two forms on the same plant, or on plants of the same species.
Diœcious. Unisexual, with the flowers of the 2 sexes borne by distinct individuals.
Disciferous. Bearing a disk.
Disciform. Depressed and circular like a disk.
Discoid. Appertaining to a disk.
Disk. The development of the torus or receptacle of a flower within the calyx or within the corolla and stamens.
Dissepiment. A partition in an ovary or pericarp.
Distichous. Said of leaves arranged alternately in two vertical ranks upon opposite sides of an axil.
Dorsal. Relating to the back.
Dorsal suture. The line of opening of a carpel corresponding to its midrib.
Drupaceous. Resembling or relating to a drupe.
Drupe. A stone fruit.
Duct. An elongated cell or tubular vessel found especially in the woody parts of plants.

Eglandular. Without glands.
Ellipsoidal. Of the shape of an elliptical solid.
Elliptic. Of the form of an ellipse.
Emarginate. Notched at the apex.
Embryo. The rudimentary plant formed in the seed.
Endocarp. The inner layer of a pericarp.
Endogenous. Descriptive of Endogens, monocotyledonous plants with stems increasing by internal accessions.
Epicarp. The thin filmy external layer of a pericarp.
Epigynous Placed on the ovary.
Epiphytal Said of a plant growing on another plant, but not parasitic.
Erose. Descriptive of an irregularly toothed or eroded margin.
Excurrent. Running through the apex or beyond.
Exocarp. The outer layer of a pericarp.
Exogenous. Descriptive of Exogens, plants with stems increasing by the addition of a layer of wood on the outside beneath the constantly widening bark.
Extrorse. Directed outward, descriptive of an anther opening away from the axis of the flower.

Falcate. Scythe-shaped.
Fascicle. A close cluster of leaves or flowers.
Fascicled. Arranged in fascicles.
Feather-veined. Having veins extending from the sides of the midrib.
Ferrugineous. The color of iron rust.
Fibro-vascular. Consisting of woody fibres and ducts.
Filament. The stalk of an anther.
Filamentose. Composed of threads.
Fimbriate. Fringed.
Fistulose. Hollow through the whole length.
Flabellate. Fan-shaped; much dilated from a wedge-shaped base with the broader end rounded.
Floccose. Bearing flocci or tufts of woody hairs.
Foliaceous. Leaf-like in texture or appearance.
Foliolate. Having leaflets.
Foliole. A leaflet.
Follicle. A dry 1-celled seed vessel consisting of a single carpel, and opening only by the ventral suture.
Funicle. The stalk of an ovule or seed.

Gamopetalæ. Plants with a corolla of coalescent petals.
Gamopetalous. Descriptive of a corolla of coalescent petals.
Geniculate. Bent abruptly like a knee.
Gibbous. Swollen on one side.
Glabrate. Nearly glabrous or becoming glabrous.
Glabrous. Smooth, not pubescent or hairy.
Gland. A protuberance on the surface, or partly imbedded in the surface of any part of a plant, either secreting or not.
Glandular. Furnished with glands.
Glaucescent. Nearly or becoming glaucous.
Glaucous. Covered or whitened with a bloom.
Glomerate. Said of flowers gathered into a compact head.
Gymnospermæ. Plants with naked seeds, that is, not inclosed in a pericarp.
Gynophore. The stipe of a pistil.

Heartwood. The mature and dead wood of an exogenous stem.
Hermaphrodite. With staminate and pistillate organs in the same flower, equivalent to perfect.
Hilum. The scar or place of attachment of a seed.
Hirsute. Hairy, with coarse or stiff hairs.
Hispidulous. Minutely hispid.
Hypogynous. Under or free from the pistil.

Imbricate. Overlapping, like the shingles on a roof.
Incumbent. Leaning or resting upon, as the radicle against the back of one of the cotyledons.
Induplicate. With edges folded in or turned inward.
Inferior. Said of an organ placed below another,

like a calyx below an ovary or an ovary below a superior calyx.

Inflorescence. Flower-cluster.

Infrapetiolar. Below the petioles.

Innate. Borne on the apex of the supporting part; in an anther the counterpart of adnate.

Interpetiolar. Between the petioles.

Introrse. Turned inward; descriptive of an anther opening toward the axis of the flower.

Inverse. Inverted.

Involucre. A circle of bracts surrounding a flower-cluster.

Involute. Rolled inward.

Laciniate. Cut into narrow incisions or lobes.

Lactescent. Yielding milky juice.

Lamellate. Composed of thin plates.

Lanceolate. Shaped like a lance; narrower than oblong and tapering to the ends, or at least to the apex.

Lanuginose. Clothed with soft reflexed hairs.

Leaf. Green expansions borne by the stem in which assimilation and the processes connected with it are carried on.

Leaflet. The separate division of a compound leaf.

Legume. The seed vessel of plants of the Pea family, composed of a solitary carpel normally dehiscent only by the ventral suture.

Lenticels. Lenticular corky growths on young bark.

Lenticellate. Having lenticels.

Lepidote. Beset with small scurfy scales.

Ligulate. Strap-shaped.

Linear. Said of a narrow leaf several times narrower than long, with parallel margins.

Lobe. The division of an organ.

Lobulate. Divided into small lobes.

Loculicidal. Dehiscent into the cavity of a pericarp by the back, that is through a dorsal suture.

Marcescent. Said of a part of a plant, withering without falling off.

Medullary rays. The rays of cellular tissue in a transverse section of an exogenous stem and extending from the pith to the bark.

Membranaceous. Thin and pliable like a membrane.

Micropyle. The spot or point in the seed at the place of the orifice of the ovule.

Midrib. The central or main rib of a leaf.

Monœcious. Unisexual, with the flowers of the two sexes borne by the same individual.

Mucro. A small and abrupt tip to a leaf.

Mucronate. Furnished with a mucro.

Muricate. Rough, with short rigid excrescences.

Naked buds. Buds without scales.

Nectar. The sweet secretion of various parts of a flower.

Nectariferous. Nectar-bearing.

Node. The portion of the stem which bears a leaf or whorl of leaves.

Nucleus. The kernel of an ovule or seed.

Nut. A hard and indehiscent 1-seeded pericarp produced from a compound ovary.

Nutlet. A diminutive nut or stone.

Obclavate. Inverted club-shape.

Obcordate. Inverted heart-shaped.

Oblanceolate. Lanceolate but tapering toward the base more than toward the apex.

Oblong. Longer than broad with nearly parallel sides.

Obovate. Ovate with the broader end toward the apex.

Obovoid. Solid obovate with the broader end toward the apex.

Obpyramidal. Inversely pyramidal.

Obtuse. Blunt or rounded at the apex.

Operculate. Furnished with a lid.

Orbicular. A flat body circular in outline.

Orthotropous. Descriptive of an ovule with a straight axis much enlarged at the insertion and the orifice at the other end.

Oval. Broad-elliptic, with round ends.

Ovate. Of the shape of the longitudinal section of a hen's egg, with the broad end basal.

Ovoid. Solid ovate or solid oval.

Ovule. The part of the flower which becomes a seed.

Palmate. Lobed or divided, with the sinuses pointing to or reaching the apex of the petiole or insertion.

Panicle. A loose compound flower-cluster.

Papilionaceous. Butterfly-like.

Papilliform. The shape of papillæ.

Papillate. Bearing papillæ, minute nipple-shaped papillose projections.

Parietal placenta. A placenta borne on the wall of the ovary.

Pedicel. The stalk of a flower in a compound inflorescence.

Pedicellate. Borne on a pedicel.

Peduncle. A general flower-stalk supporting either a cluster of flowers, or a solitary flower.

Pedunculate. Borne on a peduncle.

Peltate. Descriptive of a plane body attached by its lower surface to the stalk.

Penniveined. Same as pinnately veined.

Perfect. Said of a flower with both stamens and pistil.

Perianth. The envelope of a flower consisting of calyx, corolla, or both.

Pericarp. The fructified ovary.

Persistent. Said of leaves remaining on the branches over their first winter, and of a calyx remaining under or on the fruit.

Petal. A division of the corolla.

Petiolate. Having a petiole.

Petiole. The footstalk of a leaf.

Petiolulate. Having a petiolule.

Petiolule. The footstalk of a leaflet.

Pilose. Hairy, with soft and distinct hairs.

Pinnæ. The primary divisions of a twice pinnate leaf.

Pinnate. A leaf with leaflets arranged along each side of a common petiole.

Pistil. The female organ of a flower, consisting of ovary, style, and stigma.

Pistillate. Said of a unisexual flower without fertile stamens.

Pith. The central cellular part of a stem.

Placenta. That part of the ovary which bears the ovules.

Plane. Used in describing a flat surface.

Plumule. The bud or growing part of the embryo.

Pollen. The fecundating cells contained in the anther.

Polygamodiœcious. Said of flowers sometimes perfect and sometimes unisexual, the 2 forms borne on different individuals.
Polygamomonœcious. Said of flowers sometimes perfect and sometimes unisexual, the 2 forms borne on the same individual.
Polygamous. Said of flowers sometimes perfect and sometimes unisexual.
Pome. An inferior fruit of 2 or several carpels inclosed in thick flesh.
Posterior. The side of an axillary flower next the axis of inflorescence.
Prickle. Outgrowth of the bark.
Proliferous. Bearing offshoots.
Puberulent. Very slightly pubescent.
Puberulous. Minutely pubescent.
Pubescence. A covering of short soft hairs.
Pubescent. Clothed with soft short hairs.
Pulvinate. Cushion-shaped.
Punctate. Dotted with depressions or translucent internal glands, or with colored dots.
Punctulate. Minutely punctate.

Raceme. An indeterminate or centripetal inflorescence with an elongated axis and flowers on pedicels of equal length.
Rachis. The axis of a spike or of a compound leaf.
Radial. Belonging to a ray.
Radicle. The initial stem in an embryo.
Receptacle. The axile portion of a blossom bearing sepals, petals, stamens, and pistils; the axis or rachis of the head, spike, or other flower-cluster.
Reniform. Kidney-shaped.
Resupinate. Upside down.
Reticulate. Netted.
Retrorse. Directed backward or downward.
Retuse. With a shallow notch at a rounded apex.
Revolute. Rolled backward from the margins or apex.
Rhaphe. The adnate cord or ridge connecting the hilum with the chalaza in an anatropous ovule.
Rhombic. Having the shape of a rhomb.
Rhomboidal. Approaching a rhombic outline; quadrangular with lateral angles obtuse.
Rind. The bark of some endogenous stems, like that of Palms.
Rostrate. Narrowed into a slender tip.
Rotate. Circular, flat and horizontally spreading.
Rugose. Wrinkled.
Rugulose. Slightly wrinkled.
Ruminate. Looking as if chewed, like the albumen of the nutmeg.

Sagittate. Shaped like an arrowhead.
Samara. An indehiscent winged fruit.
Sapwood. The young living wood of an exogenous stem.
Scales. Thin scarious bodies, usually degenerate leaves.
Scarious. Thin, dry and membranaceous, not green.
Scobiform. Having the appearence of sawdust.
Scorpioid. A form of unilateral inflorescence circinately coiled in the bud.
Scurfy. Covered with small bran-like scales.
Seed. The fertilized and mature ovule, the result of sexual reproduction in a flowering plant.
Segment. One of the divisions into which a leaf, calyx, or corolla may be divided.
Semianatropous. Same as amphitropous.
Sepals. The divisions of a calyx.
Septicidal. Descriptive of a capsule splitting through the lines of junction of the carpels.
Septum. A partition.
Serrate. Beset with teeth.
Serrulate. Serrate with small fine teeth.
Sessile. Without a stalk.
Setose. Beset with bristles.
Setulose. Beset with minute bristles.
Sheath. A tubular or enrolled part or organ.
Sinistrorse. Turned or directed to the left.
Sinus. A recess between the lobes of a leaf.
Spatulate. Oblong with the lower end attenuated.
Spike. An indeterminate inflorescence with flowers sessile on an elongated common axis.
Spine. A sharp-pointed woody body, commonly a modified branch or stipule.
Spinescent. Ending in a spine.
Spinose. Furnished with spines.
Stamen. One of the male organs of a flower.
Staminate. Said of unisexual flowers without pistils.
Staminodium. A sterile or much reduced stamen.
Stigma. The part or surface of a pistil which receives the pollen for the fecundation of the ovules.
Stigmatic. Relating to the stigma.
Stipe. A stalk-like support of a pistil or of a carpel.
Stipel. An appendage to a leaflet analagous to the stipules of a leaf.
Stipellate. Having stipels.
Stipitate. Having a stipe.
Stipulate. Having stipules.
Stipules. Appendages of a leaf, placed on one side of the petiole at its insertion with the stem.
Stomata. Breathing pores or apertures in the epidermis of leaves connecting internal cavities with the external air.
Stomatiferous. Furnished with stomata.
Stone. The hard endocarp of a drupe.
Strobile. The same as cone.
Strophiolate. Said of a seed bearing a strophiole or appendage at the hilum.
Style. The attenuated portion of a pistil between the ovary and the stigma.
Subcordate. Slightly cordate.
Subulate. Awl-shaped.
Sulcate. Grooved or furrowed.
Superior. Growing or placed above; also in a lateral flower for the side next the axis.
Suture. A junction, usually a line of opening of a carpel.
Syncarp. A multiple fruit.

Taproot. The primary descending root, a direct continuation from the radicle.
Tegmen. The inner coat of a seed.
Testa. The outer seed-coat.
Thyrsoidal. Relating to a thrysus.
Thyrsus. A mixed inflorescence with the main axis indeterminate and the secondary or ultimate cluster cymose.
Tomentose. Densely pubescent with matted wool or tomentum.
Tomentulose. Slightly pubescent with matted wool.
Torose. Cylindric, with contractions or bulges at intervals.
Torulose. Slightly torose.

Torus. The receptacle of a flower.
Transverse. Horizontal.
Trichotomous. Three-forked.
Trifoliate. Three-leaved.
Trifoliolate. Descriptive of leaves, with 3 leaflets.
Truncate. As if cut off at the end.
Tubercle. A small tuber or excrescence.
Tuberculate. Beset with knobby excrescences.
Turbinate. Top-shaped.
Turgid. Swollen.

Umbel. An inflorescence with numerous pedicels springing from the same point like the rays of an umbrella.
Umbilicus. The hilum of a seed
Umbo. A boss or protuberance.
Umbonate. Bearing an umbo.
Uncinate. Hooked, bent, or curved at the tip in the form of a hook.
Unequally pinnate. Pinnate, with an odd terminal leaflet.
Unguiculate. Contracted at the base into a claw or stalk.
Unisexual. Said of flowers with either the stamens or pistil 0 or abortive.
Urceolate. Hollow and contracted at or below the mouth like an urn or pitcher.
Utricle. A small bladdery pericarp.

Valvate. Said of a bud in which the parts meet without overlapping.
Valve. One of the pieces into which a capsule splits.
Veinlet. One of the ultimate or smaller ramifications of a vein.
Veins. Ramifications or threads of fibro-vascular tissue in a leaf or other flat organ.
Ventral. Belonging to the anterior or inner face of a carpel.
Ventricose. Swelling unequally or inflated on one side.
Vernation. The disposition of parts in a leaf-bud.
Verrucose. Covered with wart-like elevations.
Versatile. Said of an anther turning freely on its filament.
Verticillate. Arranged in a circle or whorl round an axis.
Villose. Hairy, with long and soft hairs.

Whorl. An arrangement of branches or leaves in a circle round an axis.
Wood. The hard part of a stem mainly composed of wood-cells, wood fibre, or tissue.

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